SCIENTIFIC AMERICAN

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## DR. LE PLONGEON'S LATEST AND MOST IMPORTANT DISCOVERIES AMONG THE RUINED CITIES OF YUCATAN.

A recent letter from Alice D. Le Plongeon, dated at the ruins of Chichin Itza, Yucatan, gives a very interesting account of Dr. Augustus Le Plongeon's latest discoveries, from which we make the following extracts. The letter was accompanied by several fine photographs, two of which we have engraved. The others will soon appear.

In 1875, when Dr. Le Plongeon brought to light the then beautiful statue that for good reasons he called Chaacmol (Leopard), people who knew nothing about it said that he had given that name at random, or for some fancy, which assertion was as foolish as it was unjust. As among us we have Mr. White, Mr. Black, Mr. Long, Mr. Short, Mr. Wolf, Mr. Fish, so the Mayas had for names animals and other objects, and when their portraits were made, instead of inscribing their name beneath, as we frequently do, they put a picture of the animal or object whose name they bore, above their head or on their breast, sometimes both. Thus we see a dignified looking gentleman, elegantly dressed and well armed, with a pretty goblet above his head; he is Mr. Cul, cul being the Maya word for cup. From certain indications of mural paintings and sculptures, Dr. Le Plongeon was led to look in one place for the statue of a man named Leopard, and when on reaching that he saw a monument with a sculptured leopard on the top, and slabs with leopards carved on them round it, his conviction was confirmed. He then unearthed the statue of Chaacmol; and it was to the memory of that warrior that the monument I propose to describe was raised. It consisted of two apartments, the outer, without any front wall, being more like a grand portico. The front half of the triangular arched roof rested on massive round stone pillars with feathers carved on the front and sides, while on the other part the scales of the serpent's belly are represented. The base, formed of a monolith two meters long, one meter fifty centimeters wide, and one meter twenty-five centimeters high, resembles a serpent's head with open mouth, whose projecting tongue alone requires two strong men to move it. (See engraving.)

But the roof of this front room fell, burying beneath its debris the pillars and other beautiful objects between them. A thorough excavation brought to light a stone altar; the upper part, or table, consisted of two stones fifteen centimeters thick, that together were two meters ten centimeters square, or be it six feet ten inches. Most unhappily, the roof, in falling, broke the table into fragments; nevertheless, as the piece remained in place, it is not difficult to see that it was sculptured in bas-relief, representing two men, one seated, the other standing. The edge of the table is also exquisitely carved, showing priests in various postures, making offerings; of the parts least injured Dr. Le Plongeon made moulds. Smashed, even pulverized in some parts, by the enormous stones, weighing hundreds of pounds, that fell on it, the table yet served to protect fifteen figures that supported it as caryatides. These were placed three abreast, five deep, with their arms upraised. They are eighty-five centimeters high, fifty centimeters wide at the top, and thirty-five at the base. Except in their position, there are not two alike in any respect. The outermost ones have their noses broken, but those within are perfect as if just from the master's hand. They are very interesting and important, showing, as they do, the features, ornaments, and dresses of those people, for the artists paid little attention to the body, bestowing the utmost skill and care on the face, ornaments, and dress. The heads are well shaped, disproving again the assertion of some writers that the Mayas deformed their skulls. That custom was introduced by people who about 1,500 years ago invaded the country from the side of Baealax, destroyed Chichen Itza, took possession of Uxmal, and in fact became masters of the country after destroying the dynasty of the Caes, as we read in an inscription carved on the facade of one of the principal monuments of Uxmal. These Toltecs, or Naualts, with their religious rites and other customs, introduced that of deforming the skull, a practice that was in vogue even among the Mayas at the time of the Spanish conquest, as Landa informs us. Very lately a skull has been unearthed in Progreso, the port of Yucatan, quite conoidal in form, being flattened back and front, and rising like a peak at the top.

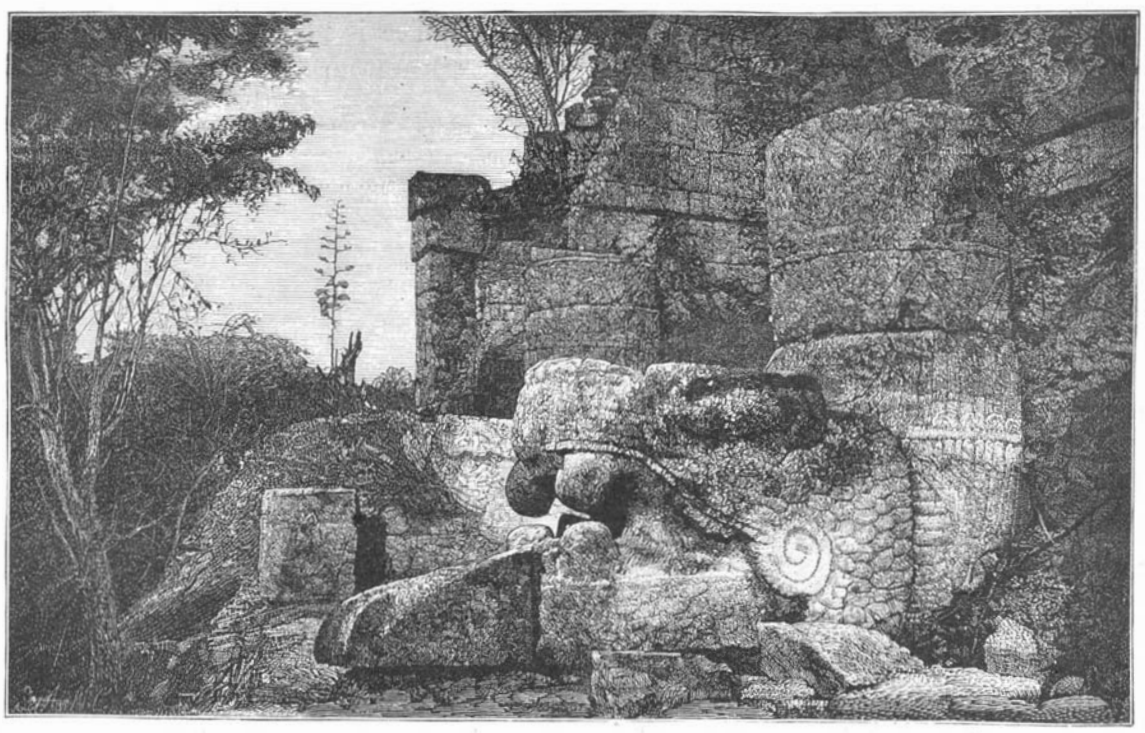
All the caryatides have headdresses on which are chiseled with great delicacy various designs, some figuring mosaic work that those people used to ornament their dresses, made of bone, shell, ivory, and each substances, cut in various shapes, and painted with bright colors. Other headgears are covered with feathers, the lines exquisitely fine; and the back of each figure is sculptured to imitate a mantle of feathers, but in each the feathers are differently arranged. Their hair is cut short in front and combed straight, to come partly over the forehead, thus we see that it is a very old fashion to *bang* the hair. The eyes are two-thirds natural size; some are decidedly feminine, and their dress seems to be that of women. The eyes are open, foreheads broad, noses correct in shape according to our present ideas of beauty, some quite small and fine; lips thin and firm. Some have the upper row of teeth visible, and they are small and even, not filed like a saw, so that fashion was evidently not compulsory, though some followed it, as we learn from the Chaacmol statue and others. All have ornaments in their noses, and some of them consist of two small disks, linked by a tiny straight bar. It is very possible that these links were made of some metallic substance. Besides the ornaments fastened on the outside of the nostrils, several have one hanging from the cartilage, down over the lips. As well as disfiguring a pretty face, it must have been most uncomfortable, and shows that people in those times made themselves the foolish slaves of fashion, just as now. One face is so covered that the features can hardly be seen; two serpent heads face each other on the forehead, and their bodies encircle the eyes; other snake bodies surround the mouth, the heads resting on the cheeks.

It is not easy for the pen to give an exact idea of how these caryatides are formed. The bodies do not correspond to the size of the faces, yet the feet are large, to serve as a firm base for the table they supported. From the knees up to the throat there is very little form, and though we see that the arms are upraised, the hands are not defined, but lose themselves in the flat part of the stone that is above the head, and on which the table rested. As far back as where the ears should be, the faces are completely in the round, but from there the stone extends on each side, and on that stone, in the place where ears should be, are large circular ornaments. One figure has square tablets instead, and on them a finely chased inscription that causes us to exclaim: "They must have had metal to work with!" The large circular ornaments have for center the face of an old man, but not all alike; so they may have been portraits of individuals celebrated among them.

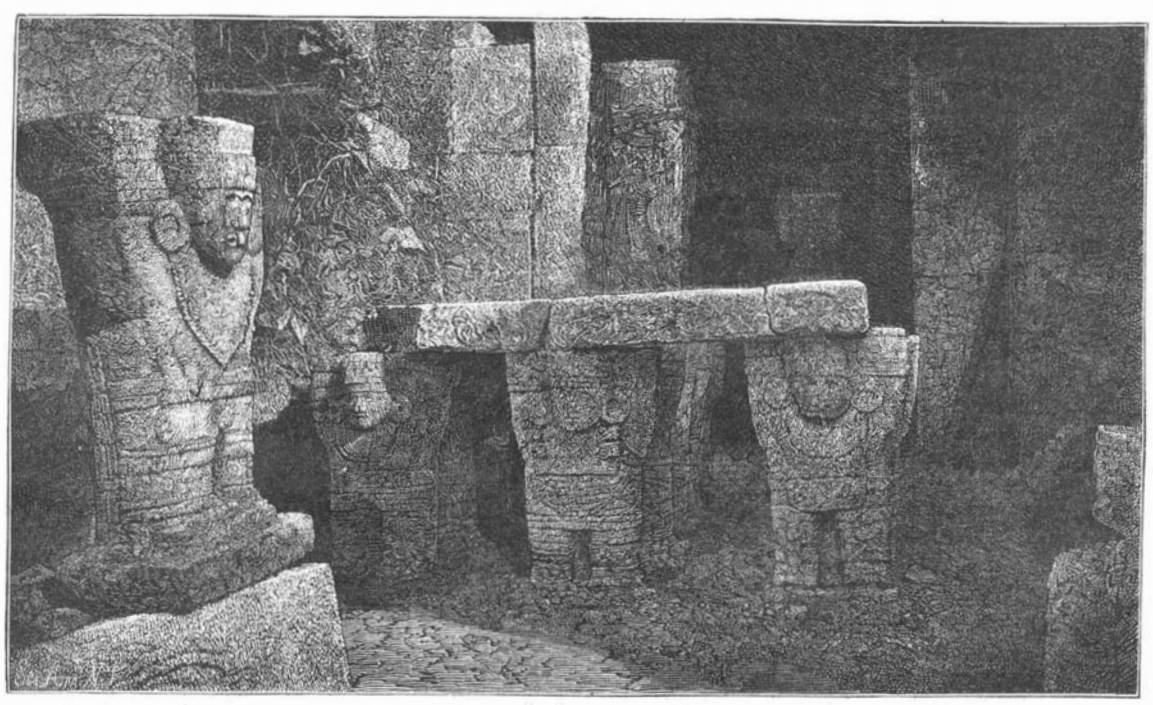
The toe nails of these figures have fallen out; for the Maya artists made nails and eyes of shell for their statues, which were also painted in vivid colors. The feet are shod with sandals, each fastened with a different bow, knot, or clasp. From their necks are suspended badges, necklaces, and other ornaments. One has an animal carved on the badge. Some have handsome waist belts, and three cornered aprons, trimmed in divers manners, especially with flat plaiting.

As so little care has been given to the body, it is not easy to decide upon the shape of the garments, but some certainly have a short tunic folded round their hips, closing in front by one end lapping over the other, the corners being curved from waist to bottom of garment.

We have reason to suppose that these figures were likenesses of individuals attached to the warrior Coh, and they supported the altar on which



THE MONUMENT OF CHAACMOL, AT CHICHEN ITZA, YUCATAN.



INNER APARTMENT OF CHAACMOL'S MONUMENT, WITH STONE ALTAR SUPPORTED BY FIFTEEN CARYATIDES.

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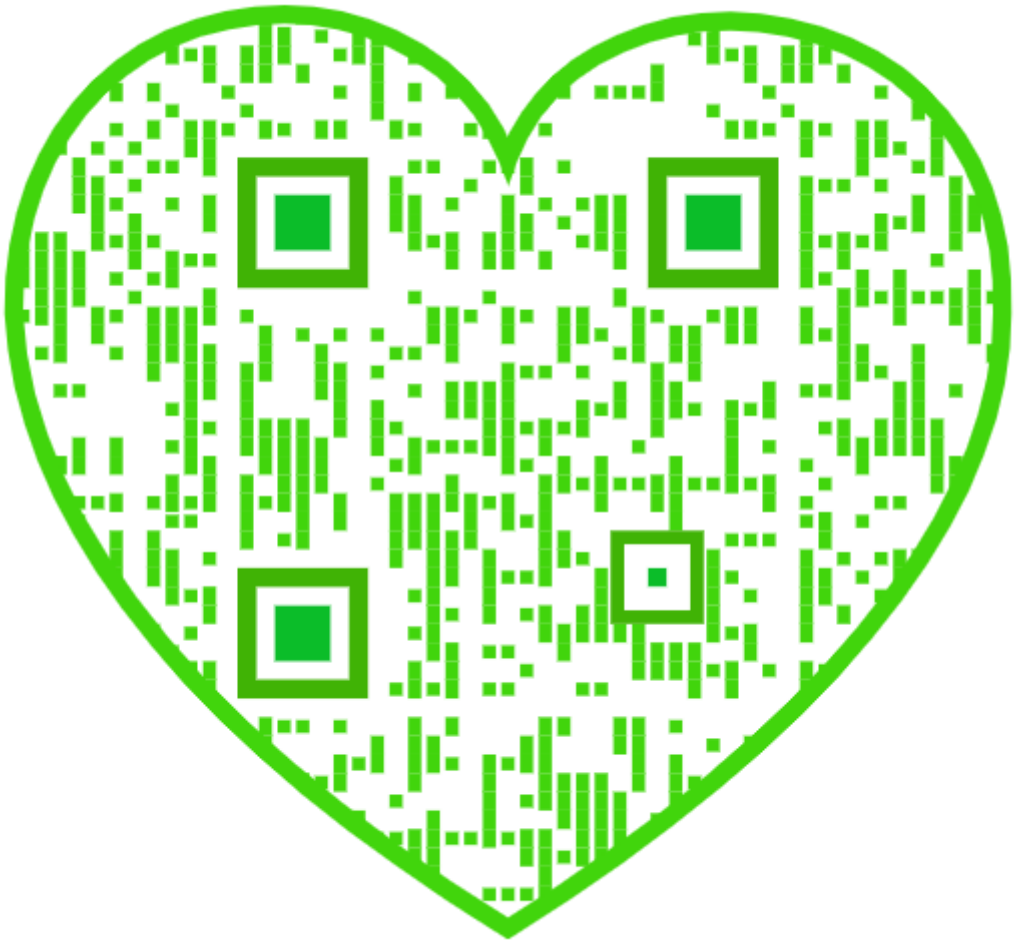

offerings were made to the manes of that chieftain. The room beyond the altar seems to have been a funereal chamber. The concrete floor was painted red; in spots the color is still bright. Opposite the doorway there is an *estrade*, half the width of the room, which is narrow, and two or three yards long. The walls are perpendicular to a height of three meters, then slant inward, forming a triangular arch, the total height of the room being about six meters. Throughout the ruins the same shaped roof is used, in some cases without any capping stone. This room has its walls covered with paintings, from floor to apex of roof. Red, blue, green, and yellow are the colors that form the pictures, but the outlines are drawn with a dark brown paint (bister); another color is also used, that I may, perhaps, call maroon, to paint boats and other objects that represent wood, for among the paintings are large boats; in one of them people painted blue are fighting with others painted yellowish-brown, and these last are apparently quite overcome by the men painted blue. Our future studies will doubtless give us a clew to all this.

### High Buildings in Cities.

The burning of the St. George's Flats, in New York City, April 7, was but one more strong proof that it is indeed high time we had some comprehensive legislation governing the whole matter of high buildings in cities. Were it not that such structures are almost invariably claimed to be absolutely fireproof, there is no doubt but their erection, to be used as dwellings, would have been prohibited ere this. But here we have a representative structure of this kind entirely burned out, except the walls, like a tinder box, or as though the whole affair was a furnace, in which the interior partitions, furniture, etc., formed the charge, and the walls were the shell. It presented an imposing appearance, was seven stories high from the sidewalk and eight stories high in the rear; the front was of stone, ornamented with terra cotta; the spacious entrance hall had polished marble columns, while the stairways in front were of stone, and the halls tiled—the apartments renting at from $1,300 to $1,800 a year—but there was a rear dumb-waiter and air shafts of wood, with wooden stairs, floor beams, and flimsy partitions; so the destruction of the building was very rapid, notwithstanding the best efforts of the fire department. The question naturally arises, How many of our so-called fireproof structures are of this character?

The law now provides for the thickness of walls, according to the height it is proposed to build, and the building department can enforce the erection of fire escapes, but there is no limit to the height to which structures for either business purposes or dwellings may be carried. A bill is before the Legislature limiting the height of dwelling houses "intended to be used for more than one family" to eighty feet, and in streets less than sixty feet in width making the limit seventy feet; but much more than this is needed. With many it is by no means clear but that such high buildings should be absolutely prohibited, except in special locations, apart from other buildings, for they so much shut out the light and air as to greatly lessen the comfort and healthfulness of adjoining houses. This may be thought a hardship, in a city like New York, where the value of land affords such an incentive for piling story upon story, but there can be no question that the law should prevent the erection of such buildings unless they can be made fireproof in fact as well as in name. And to do this, with all the combustible material it is customary to use in the luxurious furnishing of such apartments, calls for a most specific enactment, with a thoroughness of inspection which householders have been slow to see the necessity of, and at least some builders will try in every way to shirk. Such regulations, in so far as they would increase the expense of putting up these great structures, and thus limiting their number, would be doubly satisfactory. Some legislation in the same line is also needed for tall factories, employing many hands, while there are here and there office buildings, likewise, altered over perhaps to accommodate more tenants, which are not only highly dangerous to surrounding property, but quite likely at any time to furnish a human holocaust, although their owners have nominally complied with all the requirements it is at present in the power of the building department to enforce. Let us have the law before its need is further emphasized by the loss of human life in some of these unsafe structures.

### Turpentine in Infectious Diseases.

The *Med. Record* tell us that H. Vilandt writes in the *Ugeskrift for Laeger*, concerning the value of the oil of turpentine in the treatment and prophylaxis of diphtheria and the exanthematous diseases. He states that he has never seen any of these diseases spread from a sick child to other members of the family when this remedy was employed. In many of his cases no isolation could be attempted, as the mother was the only female in the family, and was obliged to take care of both the sick and the well, continually passing back and forth from one to the other. His method was to pour from twenty to forty drops of a mixture of equal parts of turpentine and carbolic acid into a kettle of water, which was kept simmering over a slow fire, so that the air of the sick room was constantly impregnated with the odor of these two substances. He claims also that by this means a favorable influence is exerted upon the exudation in diphtheria, although it is by no means curative of the disease, and should never be relied upon to the exclusion of other remedies.


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### DR. AUGUSTUS LE PLONGEON'S LATEST AND MOST REMARKABLE DISCOVERIES IN YUCATAN.

Among those who have made valuable additions to our means of studying the character and institutions of a once great but now almost unknown American people, Dr. Augustus Le Plongeon has performed conspicuous service. For some ten years he has been, at his own expense, pursuing a series of investigations among the buried cities of Yucatan. We give a record to-day of his latest and most important discoveries there, written for us by a member of his family participating with him in these explorations. Dr. Le Plongeon believes that the Maya civilization was contemporaneous with, if not anterior to, that of the most ancient Egyptian, and he certainly brings to the support of his conclusions some very remarkable facts; as presented by him they show the apparent similarity of the architecture, the language, the religion, and many of the customs of the Mayas with those of the Egyptians, so far as we can judge of either by such monuments as they have left in broken and buried statues, in the ruins of what were once extensive cities, and in the almost undecipherable hieroglyphics common to both people.

To reason, from such ground, to the possible connection in early days of the dwellers in the Nile Valley with those on the south of the Gulf of Mexico, is to open a wide door for speculation, and suggests at once the Platonic story of the sinking of the great and populous territory of Atlantis, which is said at one time to have bridged the distance between the Eastern and Western hemispheres. But there have been instances, in the prosecution of scientific investigation, where hypotheses that seemed more violent than this suggested connection of the Mayas and the Egyptians have been successfully demonstrated.

The pictures we give are the photographs themselves cut upon wood, untouched by draughtsman's pencil. The views presented are therefore, as nearly as possible, the actual reflections of the wonderful objects themselves. The Egyptic characteristics of these remains will be evident at a glance. In following numbers of the SCIENTIFIC AMERICAN we shall soon give additional illustrations. Dr. Le Plongeon has sent us a number of beautiful photographs of remarkable interest, which are now in the hands of our engravers for reproduction.

### PROTESTS FROM MANUFACTURERS.

The unwise legislation against patents lately attempted in the House of Representatives has aroused a feeling of alarm among manufacturers in different parts of the country, and they are sending to the Senate some very strong protests against the passage of any ill-advised measure. It is as yet uncertain what action the Senate will take. It is known that some of the Senators are strongly opposed to any tampering with the patent laws or to the enactment of any scheme for the depreciation of patent property. But it is feared the majority in the Senate may, like that in the House, be disposed to do real mischief. A hopeful sign however is that the sending in of remonstrances has had the effect in the Senate to postpone action upon the patent bills; and the presentation of additional protests, will unquestionably have much influence in extending the postponement, and perhaps finally defeat the bills. We therefore urge the friends of home industry everywhere to continue their efforts to put a stop to these measures. They should send individual protests; call meetings of suitable corporations and societies to pass resolutions; ask their several State legislatures to do the same; request the editors of local newspapers to discuss the subject editorially; send marked copies to all Senators and Representatives. In short, use every possible exertion, without loss of time, to enlighten the members of Congress and influence their action as far as possible against the commission of these legislative errors.

It must not be forgotten that two very obnoxious bills, those of Mr. Calkins, 3,925, to compel owners of patents to pay counsel fees to the lawyers of infringers, and of Mr. Vance, 3,934, to allow anybody who chooses to infringe until he gets notice, and after that to deprive the patentee of the control of his patent, have passed the House by overwhelming majorities, and are now before the Senate for concurrence.

The bill introduced by Senator Voorhees, which practically gives to anybody who wants it the free right to use any patent, and openly robs the holder of a patent of the exclusive right of manufacture, is now before the Senate, and its passage will be strongly advocated. The House bill of Mr. Anderson, 3,617, reducing the lifetime of patents from 17 years to 5 years, has not yet passed, but very likely will go through. The adoption of any one of these bills by both branches of Congress would have disastrous effects upon all manufacturing properties and industries. These, to the enormous extent of eight-tenths of the gross capital employed, are, according to Senator Platt, of Connecticut, based directly or indirectly upon patents.

If any editor wishes for first-rate data on which to write interesting articles concerning American inventions and manufactures, we would refer him to the recent speech upon the Reorganization of the Patent Office, by Senator Platt, given in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 432. In this remarkable document will be found a most valuable array of facts and figures, beginning with the early history of the country and brought down to current dates.

The Jarvis Engineering Company, of Boston, has a large capital employed in the manufacture of various patented devices, such as furnaces, steam engines, injectors,

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lathes, etc. We give below a copy of the protest lately sent by them to each of the seventy-one Senators in Congress; we advise all other manufacturers to speak out strongly at this juncture, and let the Senate promptly hear from them.

SENATORIAL PROTEST OF THE JARVIS ENGINEERING CO.

DEAR SIR: We wish, most respectfully, to protest against the House bill No. 3,617, in regard to reducing the life of a patent from seventeen years to five years. We are doing business under patents issued to Mr. Kingsbury M. Jarvis in the year 1876, and it took us over five years to get them introduced and put on a paying basis; this was only accomplished after sinking a large amount of money and doing the hardest kind of work.

We wish, also, to protest against Senate bill No. 1,588, as we feel that, if it passes, inventors and owners of patents will have no protection. We have spent thousands of dollars in defense of our patents, and, under this law, all our labor and expense will have been thrown away.

Yours respectfully,

JARVIS ENGINEERING CO.,
A. F. UPTON,
*Treasurer and General Manager.*

Boston, April 4, 1884.

## IMPROVEMENTS IN MEN AND MACHINES.

It would be a curious study to ascertain how far the improvement in machines and in tools had kept pace with that in the skilled mechanic. One thing is certain, at the beginning of the inquiry, that a skilled mechanic is of just as much value to-day as ever. How much he has improved is a question for scientific examination rather than one for absolute statement. It would be a queer assertion that the men of fifty years ago were inferior to those of the present. All the facts of the past, as well as those of the present, show that our present mechanics are no more mechanics than those of half a century ago. All the great improvements in hand tools and machine tools for the last fifty years have come from the individual efforts of men who had done their work before the present advent of machine and automatic tools. These men—these workmen and inventors—made possibilities out of suggestions, and realities out of imaginings. To them belong the realities of the present machine shop.

It would seem from this that it is not the tools and the appliances that make the workmen, but the workmen who make the tools. There are just as good mechanics to-day, with all our mechanical appliances for good work, as there were when every job required a new arrangement of tools for work. In fact, the improvement in machines presupposes the capacity of the machine makers.

And yet these improvements have their influence on the workman; the better the tool, the more exactive the workman. There are gray headed, almost superannuated, workmen in our shops who have voluntarily discarded all their old time notions to take up with some "new fangled trick" that has been proved to be an advance toward perfection. Every improvement in tools—induced and perfected by mechanics—tends to an advance in the true mechanical improvement of the workman.

## AMERICAN STANDARD FOR BOILERS.

"The American standard for horse power, as generated in steam boilers, is described by the SCIENTIFIC AMERICAN as the unit of 30 pounds of water evaporated hourly. This datum applies to the boiler only, and is irrespective of the engine by which the steam is utilized. The Committee of the Centennial Exhibition of 1876, to whom was referred the testing of steam engines and boilers, first formulated this unit in calculating the power of boilers, and their determination has since been generally accepted by American engineers. Hence the nominal horse power of a boiler is ascertained in use, without reference to heating surface, by observing the weight of water evaporated hourly, and dividing by 30. It has been found that the best class of engines, in good working order, will give 1 horse power from the steam of 18 pounds of water per hour, or less. On the other hand, badly constructed engines, out of order, have consumed as much as 60 pounds of water, in the shape of steam, per horse power per hour. The weight of the fuel consumed in steam generation is a product of the combined excellences and defects of engine and boiler. A good boiler will evaporate 11 or 12 pounds of water per pound of coal, which is equivalent to the production of the standard unit of horse power with as little as 2½ pounds of coal per hour. On the other hand, many boilers scarcely evaporate 5 pounds of water per pound of coal. Combining the best qualities and performances of both engines and boilers as given by the American writer, it will be seen that 2½ pounds of coal should evaporate 30 pounds of water, which should produce nearly 2 horse power in the engine, or a net result of little more than 1¼ pounds of coal per horse power per hour. It might be interesting to learn when, and under what conditions, any such record of a working performance was ever obtained."—*Journal of Gas Lighting.*

While we approve the general tenor of the above criticism, we would call the attention of the writer to the clause, "The weight of fuel consumed in steam *generation* is a product of the combined excellences and defects of *engine* and boiler."

Here appears to us a slight error: The weight of fuel consumed in steam *generation* depends upon the excellences and defects of the boiler *only*; the character or condition of the engine by which the steam is used or *consumed* has nothing whatever to do with the *generation*; even if the steam was blown off by the safety valve, it would have no bearing or effect upon the question of economical generation.

The writer, by assuming what may be considered the very best of boilers as generators, and the very best of engines as consumers of steam, arrives at the result of one horse power for 1¼ pounds coal per hour, and asks if such result was ever obtained. Now, if he will examine closely results obtained at test trials, where everything is supposed to be in best adjustment and condition to secure economy, he will find that this economy of 1¼ pounds coal (or within a small fraction of it) per horse power per hour has been accomplished.

We do not, however, pretend to claim that this economy has been frequently attained, even in careful tests for economy; average results of every-day practice are much more wide of such result.

Now, the writer has assumed the very best condition of boiler and engine in the calculation given above; but let us take the case of *good* every-day practice, and we assume 8 pounds water evaporated per pound of coal, which is fully up to average evaporation. Then 30 pounds water will require 3¾ pounds coal per horse power per hour, assuming that 30 pounds are required by the engine, which we think is rather below than above the average of engines now in use. But if we allow that only 24 pounds per hour are required by the engine, then the consumption of coal will be 2½ pounds per horse power per hour, which is not a very uncommon result with compound engines.

## SUGGESTIONS FOR INVENTORS.

There are many inventive minds that are comparatively idle for the reason that the wants of the people are not thoroughly understood. In order that inventors may get an idea of what is needed in the way of improvements, and that would be tolerably certain to bring a reasonable reward to the inventor, a brief mention will be made of a few needed improvements in railway appliances.

The numerous and frequent accidents and delays to railway trains on account of snow, point to the fact that better appliances for removing snow and ice are needed, and now is the time for observation and experiment. The man who will bring out an improved snow plow and flange clearer will be well paid for his labor.

Accidents from broken parallel rods are becoming more frequent than formerly, and an improved construction of that overworked and abused part of a locomotive is called for. But in order to be successful in designing an improved parallel rod it is necessary to study the nature of the various strains, jars, shocks, and vibrations—lateral, centrifugal, and otherwise—to which the rod is subjected. Owing to the peculiar duties the rod has to perform, it is desirable that its strength be increased as much as possible without a corresponding increase in weight.

Notwithstanding the fact that our railway lines have adopted the most approved signal appliances for the safe running of trains, collisions are yet too frequent, and something reliable in this line is needed. Some of the systems now in use are reliable when in good order, but their liability to derangement renders them dangerous, and there is room for improvements in this direction. Many disastrous collisions are caused by defective drawtackle. Pins and links break and draw bars pull out, and trains breaking in two is a fruitful source of disaster. Better fastenings for draw bars, and links made of wire cable by some process yet to be discovered, would yield a fortune to the inventor. It would not seem to be a difficult matter to make a machine that would convert wire into links by a winding and welding process; that is, make a wire link. The nut lock men have not yet succeeded in producing a perfect lock. There are those that will give satisfaction in certain places, as in agricultural machinery, carriages, etc., but no satisfactory lock has yet been devised for track fixtures. As the safety of railway travel depends largely on the condition of the rail joints, a more efficient nut lock is among the wants of railway officers.

A great many serious railway disasters have resulted from the spreading of rails. On roads of heavy traffic the ordinary spikes are inadequate to resist the strain imposed upon them, and the plan of double spiking is objectionable on account of injury to the cross ties. Moreover, the extra spikes do not always prevent spreading, and a "rail brace" is sought for. This must be so formed that a single spike passing through the brace will give greater resistance to strains than two, or even three, ordinary spikes driven in the ordinary way. This is not impossible, and the manner in which it may be accomplished may not be regarded as a conundrum by any one who will give the matter a little thought.

Timber for railway ties is rapidly growing scarce, and the time is now at hand to cast about for a substitute for wood for this purpose. Indeed, inventors are already in the field with various plans of relief for the coming want. Glass has been suggested and tried in Europe. Cast and wrought iron have been used with some degree of satisfaction in countries where frost was not injurious to those materials, and a combination of wood and iron may be made a comparatively cheap and desirable substitute for wood for cross ties in any climate. Straw and sawdust can be made to do duty as wood cut from the tree for many purposes. In cutting ties from timber it is necessary that the trees be of suitable size. There is a vast amount of small, crooked, gnarled timber that is entirely unsuited to the manufacture of ties. Perhaps, by some process yet to be invented, this timber may be utilized and brought in shape for ties and other purposes. Perhaps other waste material may be utilized for this purpose. A combination of materials that are now regarded as waste or "in the way" may, perhaps, be made valuable by study on the part of inventors. In producing a substitute for wood for ties the inventor must not lose sight of the fact that a certain amount of elasticity must be provided for. There is a bonanza for the inventor of the coming railway cross tie.

Accidents at crossings are yet numerous, notwithstanding all that has been done to prevent this class of horrors. The proper place for an alarm is at the crossing, and it must be so located that it will be sure to warn people in time for them to avoid collision. There are some automatic alarms in use, but, like other automatic appliances, are susceptible of improvement. In short, there is hardly any safety railway appliance but may be improved, and inventors who are seeking for profitable fields of labor will do well to investigate the causes of railway accidents and devise means of greater safety to life, limb, and property.

The foregoing will indicate the direction in which inventors may work with profit, and although the ground in the main has been worked over, there is yet room for valuable improvements. With many inventors it is as difficult to know what to invent as it is to perfect the device when once in hand. "What shall I invent?" is a question often asked by prolific inventors who are equal to any task set for them, but who are at a loss for ideas to start them in the right direction.

## THE CHEAPNESS OF COST.

The time has gone by when cheapness was considered one of the good qualities of tools. Fussy finish also, that indicates nothing but the idle fancy of the tool fashioner, is held as slightly in favor by mechanics. The main object in the production, the choice, and the use of tools is to make, select and use the best, with much less regard to cost or price than to absolute value and useful life.

This unquestionably has improved the quality of the resultant work, and within twenty-five years this improvement has been so great as to attract the attention of those who are merely casual observers. Such fits, and accuracy, and exact results as are common now, but would have been deemed almost impossible twenty-five years ago, have been brought about largely by the use of accurate and costly tools. Adjustable and interchangeable lathe and planer tools are steadily taking the place of the forge-fashioned bars of steel although costing very much more at first. The bits or cutting portion of these tools are forged and milled accurately and finished to exactness. Some of them are threaded for adjustment; some are carefully milled to unequal sides, so that a cross section would be a trapezium instead of a square or a diamond, and some are accurately termed disks fitted and finished by gauge. But with all their cost of labor and price of money they do the work so much better, last so much longer, and require so much less attention that their cost is cheapness.

Not many years ago the tap wrench was scarcely dignified by the title of tool in the shop; any bar of iron, of convenient length, with a hole punched through it somewhere between the two ends, to go over the squared top of a tap, or a reamer without turning around on the squared top, was a sufficient tap wrench. One of the most prominent builders of large machine tools and small hand tools, as taps, dies, reamers, etc., said recently that he had much difficulty in introducing a perfectly balanced tap wrench to accompany his taps; the purchasers of the taps believing that anything that would turn the tap, if nothing more than an ordinary wrench, was sufficient. Such purchasers broke a much larger proportion of hand taps than of machine taps the torsion of which is necessarily even. But a balanced and exact tap wrench in the hands of a careful workman will add vastly to the useful life of the hand tap. This view is reasonable, for in use the tap and its wrench are essentially one, and should be moved accurately and synchronously together. This exactness in the making of so simple a tool as a tap wrench is an illustration of the advance that has been made in the improvements which demonstrate the cheapness of cost.

## Grief in the Dog.

Mrs. Walter Odell, of Stapleton, Staten Island, died at 3 o'clock on Tuesday morning, March 25. A Scotch terrier, Fido, had been her pet for twelve years. During the two months of her illness Fido remained beside her bed. After her death he persisted in lying beside the coffin. He followed it to the hearse, and tried to jump inside the hearse. When the procession reached the grave, Fido was there. After the funeral he took up his former position beside the bed lately occupied by Mrs. Odell. He refused to eat.

Two days ago he found a pair of shoes that formerly belonged to Mrs. Odell, but had been thrown out of doors. These he took up in his mouth and carried to his self-assigned post near the bed, and, placing the shoes on the floor, laid his fore paws and head across them, in which position he remained several hours. During Monday night, 31, he roused the household by his mournful cries. At 3 o'clock on Tuesday morning, exactly one week to an hour after Mrs. Odell's death, Fido died beside the bed, his head and paws resting on the shoes.—*N. Y. Sun.*

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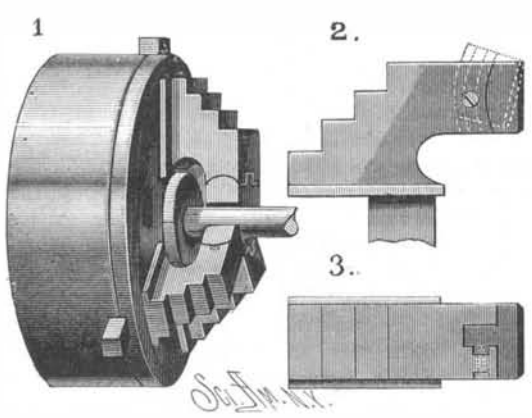
### NEW LATHE CHUCK.

Those who have been annoyed by the difficulty of firmly holding tapered or headed work in the ordinary chuck will be interested in an invention recently patented by Mr. James S. Gilmore, of 4,727 Penn Street, Philadelphia, Pa. A self-adjusting jaw face, shown in side elevation in Fig. 2 and front elevation in Fig. 3, is fitted in each jaw by making the jaw proper concave on its face in the direction of the axis of the chuck, and grooving it in the same direction; the jaw face is provided with a corresponding convex back and tongue. This jaw is secured by a stud pin screwing through one side of the jaw to a notch between two short side ribs on the tongue. The jaw faces, being free to move along their seats within the limits of the ribs, will come self-actingly to a bearing on a tapered object when screwed up




GILMORE'S NEW LATHE CHUCK.

to grip them, whether by a universal adjusting device or an independently acting one.

The jaws are also constructed with undercut notches (Figs. 1 and 2) to make a clear space behind the gripping faces to enable them to grasp the shank of a bolt over the head.

### IMPROVED TORPEDO BOAT.

We give an illustration of a new torpedo boat constructed for the English navy by Yarrow & Co. *Engineering*, from which our cut is taken, says: These boats form part of the equipment of the large war vessels in the navy, and consequently both the dimensions and weight are very limited. The system formerly adopted for discharging the torpedo from this class of boat may be briefly described as follows: On each side of the boat there was a skeleton steel cradle or frame provided with suitable guides into which the torpedoes were placed. These cradles were slung in davits and arranged so that they could be easily lowered below the surface of the water. When the torpedo was completely immersed, it was allowed to pass out of the cradle by its own mechanism, taking a direction parallel to the boat itself, and very excellent practice has been made with this plan; but as a considerable loss of time must clearly ensue in the lowering and starting, and as it was found difficult to aim when the boat was traveling at anything but a very slow speed, the arrangement was not satisfactory. Messrs. Yarrow & Co. have since then adopted a system of steam impulse; it consists in building into the forward part of the hull—as will be seen from the illustration—two troughs or half tubes, parallel to each other, in which the two torpedoes comprising the armament of the craft lie ready for use. Immediately behind, and under a steel covering, are a couple of impulse tubes, consisting simply of two long thin steel cylinders, provided with pistons and piston rods, the forward end of which press against the extreme after end of the torpedo. There are hinged covers which are lowered when the torpedo is in its place; this steam impulse gear is so arranged that at the will of the officer in charge, either one or both torpedoes can be instantaneously ejected by steam from the main boiler without causing any loss of speed to the boat or necessitating the presence of any of the crew on deck. The speed trial of one of these second class torpedo boats, loaded, built for the Admiralty, took place on the Thames last year, when 17·27 knots were obtained. After the speed trials were terminated, the steam impulse gear was tested at Portsmouth, and was found to be highly satisfactory, being, without doubt, far better than the side cradle system previously in use.

IMPROVED TORPEDO BOAT WITH IMPULSE GEAR.

### A Bill to Assist Inventors in Making Drawings.

The following neat little bill has been introduced in the House of Representatives by the Hon. Mr. Vance, of North Carolina:

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That drawings intended to explain any device or anything whatever that is patentable shall be made at the cost of the Government, under the direction of the proper authorities in the Department of the Patent Office, and without cost in any case to the inventor.

If all members of Congress were as willing to encourage inventors as the Hon. Mr. Vance, the probability is that many thousands more of new inventions and new industries would be annually brought to light. This bill is very good as far as it goes, but does it go far enough? Is it just the thing to allow the inventor to go hungry or thirsty while he is waiting at the Patent Office to give explanations about his drawings? Ought not Mr. Vance to add another section to the bill, covering refreshments, together with lodgings and transportation.

### The Silk Weavers of Lyons.

Mr. Porter in a letter to the *Tribune* states that it is impossible to compare the earnings of silk operatives in Germany and France with those in the United States, because power machinery is almost exclusively used at home, while in France and Germany 90 per cent of the work is done on the hand loom. The raw material is given out either directly to the men by the large manufacturers or by what are called patron masters, who are really a species of "fogger." These small masters make a decent living, earning from 2,400 to 2,500 francs a year, or about $500, which enables them to live comfortably. The poor weaver of black silk dress goods only makes 2 francs (40 cents) a day, and on the finer grades 3 francs (60 cents). Many of the toilers at Lyons are born, live, eat, sleep, and die in the same room. While walking through the streets the clatter of the loom is heard away up to the sixth and even seventh story.

"The loom occupies the largest part of the room. Upon a tiny stove the next meal is cooking, and while watching it the wife is arranging the shuttle. There is an air of barrenness about the room, and nothing homelike. A common print or some religious symbol is on the whitewashed wall. No carpet is on the floor. With the weaver it is work or the cafe. The weaver and his wife and children wear outer garments that are clean. They will appear better on the street than their English brethren. Their garments are principally cotton, and are washed in public. Projecting into the river may be seen hundreds of little stalls, which are rented by the day or hour for a small sum, and here the women assemble and wash the soiled rags of the town. The silk weavers are physically an inferior race, and many of the young men are exempted from military service on account of weakness." In 1883 the silk industry of Lyons gave employment to 150,000 persons.

### MEMORANDUM BOOK AND PAD.

To the cover of a plain memorandum book, of a size adapted to be carried in the pocket, is attached a slip pad. The other cover of the book is provided with a carbon paper attachment, which is composed of a heavy paper flap attached to the cover by rivets. The frame holding the carbon paper folds back upon a leaf that folds in between the leaves of the book—as shown in the upper engraving—so that when the book is closed the leaf, frame, and paper serve as a bookmark; the leaf also serves to hold the carbon paper

SILBERMAN'S MEMORANDUM BOOK AND PAD.

in its proper place, so that when the book is opened for making a memorandum it is only necessary to tip the frame over upon the right-hand side of the book to bring the carbon paper into position for use. A slip is then taken from the pad, placed upon the carbon paper, and the memorandum written with a lead pencil; a facsimile will be produced upon the leaf of the book. The frame will then be raised sufficiently to permit the sheet having the memorandum written upon it to be turned, when the parts will be arranged as before, and the book placed in the pocket ready for the next entry. The book is very convenient and easily used, and, by the use of the frame, the carbon paper is always held in a flat position.

This invention has been patented by Mr. S. J. Silberman, of 79 Canal Street, New York city.

### Steam Engine Practice.

As a comment on the able *resume* of "Present Steam Engine Practice" in the SCIENTIFIC AMERICAN of March 8, 1884, it is not improper to state that, from a number of personal observations and from reported results, the introduction of "high speed" engines in machine shops and iron and other metal manufacturing establishments is not satisfactory.

There are places where the rapidly running engines, with a piston speed of 600 or more feet per minute, are at home; but their proper place is not the machine shop, if reports and facts agree. One of the largest and best known manufactories of metal goods in New England ran its works satisfactorily with a slow moving engine. To accommodate additional demands, the cylinder was rebored and other changes made that added largely to the capacity of the engine. Except for this enlargement the engine required no doctoring, and before and after the change could be relied upon to do its work.

An addition to the works was made three years ago, and a little buzzing engine put in to run it. The claim was made that the little wasp had more power than the old fashioned traveler. But the result comes in frequent repairs and inconvenient stoppages; six hundred dollars having been expended in repairs on the rapid moving engine within two years—four times as much as has been expended on the old engine, that has run evenly for eighteen years.

There are slow moving engines of thirty years ago or more, in the New England States, built, some of them, by concerns now out of existence and bearing the names of men on their claim plates who have "gone over" and left only their memories as mechanics, which do their work as honestly as some of the machines that to-day assume to displace them. They were built for their work, and not to illustrate a theory. H.

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### An Instrument for Measuring Hearing Capacity.

At the *conversazione* held by the Cambridge Medical Graduates' Club, at the Marlborough Rooms, London, Feb. 29, Mr. Dalby lent for exhibition an instrument, the accuracy of which many of those present had the opportunity of testing. We subjoin the description:

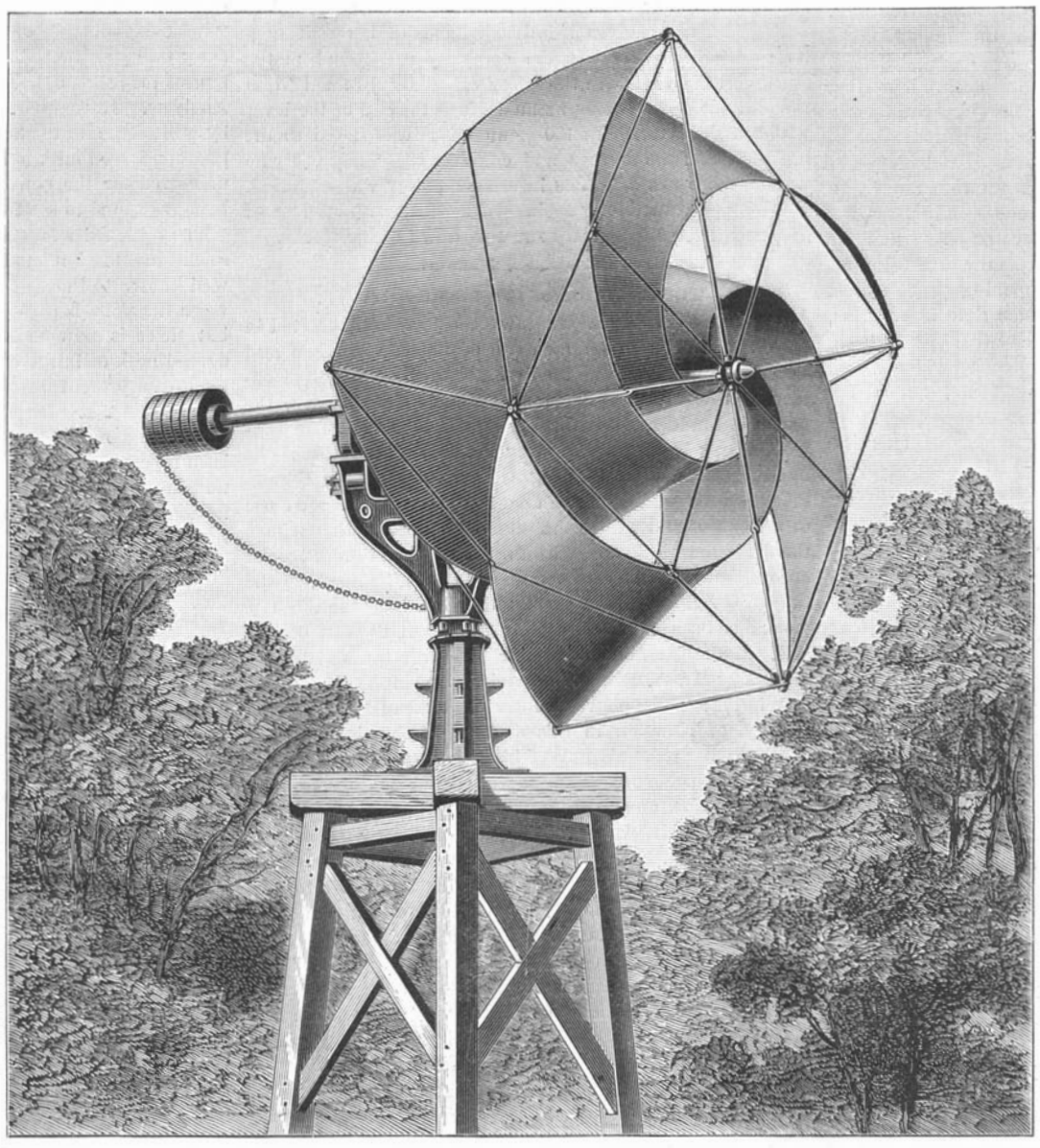
"Professor Hughes invented this instrument to be used with the induction balance as a scale of sound for comparison with it. During the past twelve months I have made use of it for the purpose of measuring variations in hearing power, and registering such variations with absolute accuracy. The registration can be made with perfect facility by the patients themselves. The telephone being applied to the ear, the patient can move the sliding coil from left to right until the clock movement can be heard. The point can then be registered in millimeters, which are 200 in all. It is an electrical instrument, and is used in connection with the telephone. The nature of its construction is as follows:

"At each end of a wooden bar divided into millimeters a flat wire coil is fixed, and a similar coil is mounted on the bar, capable of being slid from one coil to the other. One of the end coils is much smaller than the other two, in order to shorten the scale. To the middle coil the telephone is attached; the battery (in the circuit of which is a microphone) and clockwork for making and breaking the circuit are in connection with the two end coils. The wire on the said coils is wound in the reverse direction, so as to produce a neutral point between the coils. The middle coil being slid upon the bar, currents are induced in it relative to its position between the coils, its maximum point being next to the large coil, and its silent position near the small coil. The position of the coil is read off by figures on the scale. The electric currents are of short duration, being produced at the moment of making and breaking the circuit by the clockwork. One cell is sufficient to work the apparatus. It is advisable to put the clockwork at some distance from the sonometer, that the noise from the wheels running may not interfere with the sounds in the telephone."

### THE ATMOSPHERIC TURBINE.

The accompanying engraving (from *La Nature*) represents a new form of wind motor called by its inventor, Mr. A. Dumont, an atmospheric turbine. The principal value of this apparatus lies in the form of the sheet iron sweeps that store up the power of the wind, these possessing the remarkable property of revolving more rapidly under the action of a slight breeze than under that of a strong wind. For example, when one of these motors, free from all constraint, is actuated by a breeze of two meters per second, its driving wheel runs at the circumference at the rate of four meters per second, a velocity double that of the wind. When actuated by a wind of ten meters per second, the same wheel acquires a velocity of eleven meters only, or one about equal to that of the wind. In this, the apparatus forms an exception to the general rule, which is that all known windmills revolve with a velocity proportional to and thrice that of the wind, that is to say, with so great velocity that during gales they must be stopped in order to prevent them from breaking.

The turbine under consideration owes to such a property the sensitiveness of its wide spread of sail to the least breeze; and to it, likewise, it owes its excellent performance during those strong winds that alone possess true power, while all other wind motors have to be stopped in order to prevent them from being destroyed. According to data furnished by the inventor, it appears that this turbine possesses a mean motive power triple that furnished by any similar motors that have hitherto been employed.



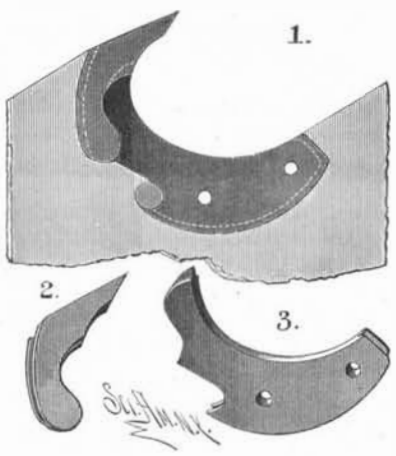
THE ATMOSPHERIC TURBINE.

### Resemblance of Boron Compounds to those of Acetic Acid.

Prokofjew presented a paper to the Russian Chemical Society in November last, in which he pointed out certain curious analogies between the acetic acid residue ($C_2H_3$) and boron. Beginning with anhydrous boracic acid ($B_2O_3$) and acetic acid ($C_2H_3)_2O_3$), he showed that each was really a sesquioxide; that borax ($Na_2B_4O_7$) corresponds to a compound obtained by combining acetic anhydride with potassium acetate, ($K_2C_2H_3)_4O_7$); while the boride of nitrogen (BN) represents acetonitrile ($C_2H_3N$).

### SAW TOOTH.

The accompanying engraving represents an invention recently patented by Mr. R. W. Kellen, of Albion, Cal. Fig. 1 is a side view showing the tooth and shank in place; Fig. 2 is a perspective view of the tooth, and Fig. 3 shows the shank. The back of the tooth is curved and grooved, as usual, but the front is made in the ogee form, the shank being made to correspond; and as the inner end is wider than the central portion, the possibility of its flying out is prevented so long as the shank remains in place. A long and strong nib on the shank enters a groove in the tooth and holds it securely against being pressed out laterally by the file. A groove extending along the back and end of the shank fits on a rib in the saw plate.




KELLEN'S SAW TOOTH.

An oval rivet is placed in an oval-shaped hole formed between the shoulder of the shank and the spur of the plate; a quarter turn of the rivet draws the shank firmly down to place, and tightly secures the tooth. The rivet is held in place by upsetting. By this construction the tooth is held firmly, and by making the joint between the tooth and shank a reversed curve, the centrifugal action of the tooth causes its gradually curved inner end to wedge up between the upper end of the shank and saw plate, thereby automatically tightening itself.

M. PASTEUR and his collaborators have announced to the French Academy of Sciences the fact that by inoculation they can render all dogs absolutely proof against the effects of rabies, in whatever way or quantity the virus may be administered.

### An Invention that was "Not" Patented.

Sir Henry Bessemer had made several inventions before he commenced the investigations that led to the completion of the Bessemer converter. One of these inventions was the manufacture of bronze powder. This was selling in England in 1840 at about $28 per pound, while the raw material cost only 22 cents a pound. The manufactured article came from Germany, and how it was made was not known in England. Young Bessemer set to work to manufacture the powder by machinery, and, after two years' persevering effort, succeeded. In order to obtain all the advantage possible from his invention he determined to keep it secret, and therefore sent sectional drawings of the machinery needed to different engineering works, thus obtaining the parts piecemeal from different portions of England. This machinery he put together himself—a work that occupied him nine months—and then engaged confidential assistants, paying them high wages on condition that everything was to be kept strictly secret. His five machines, thus started, produced as much as sixty skillful operatives could by the old methods.

To this day the mechanical means by which this famous gold paint is produced remains a secret. The machinery is driven by a steam engine in an adjoining room, and into the room where the automatic manufactory is at work none but the inventor and his assistants have ever entered. When a sufficient quantity of work is done, a bell is rung to give notice to the engineman to stop the engine, and in this way the machinery has been in constant use for over forty years without having been either patented or pirated. Its profit was as great as its success. At first he made 1,000 per cent profit; and though there are other products that now compete with this bronze, it still yields 300 per cent profit. "All this time," says the successful inventor, thirty years afterward, "I have been afraid to improve the machinery, or to introduce other engineers into the works to improve them. Strange to say, we have thus among us a manufacture wholly unimproved for thirty years. I do not believe there is another instance of such a thing in the kingdom. I believe that if I had patented it, the fourteen years would not have run out without other people making improvements in the manufacture. Of the five machines I use, three are applicable to other processes, one to color making especially; so much so that notwithstanding the very excellent income which I derive from the manufacture, I had once nearly made up my mind to throw it open, and make it public for the purpose of using part of my invention for the manufacture of colors. Three out of my five assistants have died, and if the other two were to die and myself too, no one would know what the invention is."

Since this was said, in 1871, Sir Henry has rewarded the faithfulness of his two surviving assistants by handing over to them the business and factory.

### A Model of the Eads Ship Railway.

As an aid in getting the capital to build the Tehuantepec Ship Railroad, Capt. Eads is having a working model made to illustrate in detail the devices needed for raising and lowering ships at the harbors, and distributing their weight on the wheels of the cranes on which the ship will rest during its transit across the isthmus. The *Railroad Gazette* mentions this as a convenient method of explaining contrivances to non-professional persons, but one from which the engineer can seldom gain much information as to the feasibility of the methods used when applied to a gigantic and complicated structure. The model will also show the method of side tracking the loaded cradles and the means by which the direction in which the traveling cradles is changed by turn tables instead of curves. The ship will be 7 feet long and the cradle 76 inches. The floating dock will be 90 inches long and 30 inches wide, and the basin in which it floats will hold about 500 gallons of water.

According to the latest surveys, the heaviest gradient on the Atlantic side does not exceed 42 feet per mile, while that on the Pacific is only 52 feet for about eight miles, and the remainder of the route will have no grades exceeding 26 feet per mile. It is said that no exceptionally heavy work will be encountered either in cuts or embankments, and the entire road from the Coatzacoalcos River to the Pacific harbor will be only 134 miles long.

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### Society of Amateur Photographers of New York.

Under the above title a new photographic association has lately been organized in this city; and if we may judge from the numerical strength and varied talents of the membership, the society has before it a very interesting and useful career. It embraces people of literary pursuits, editors, lawyers, scientists, clergymen, bankers, merchants, etc. It is evident that a very little effort on the part of such members would give spirit and interest to the general proceedings. The meetings are to be held monthly. Good rooms are to be provided, with library, fine instruments, and laboratory specially arranged for photographic experimental purposes; the latest and best processes and improvements in the art will be exhibited and explained; adventures and experiences related, new pictures by members thrown upon the screen; exchange of pictures by mail arranged; reports of proceedings prepared for publication, etc.

All who are interested in photography and its innumerable applications in practice will enjoy many advantages from membership. A local name has been adopted simply to fix the permanent headquarters of the society; but the membership is by no means intended to be local. Amateur photographers residing in any part of the country, both ladies and gentlemen, may become members on payment of the annual dues, $5.00 a year. For this purpose the secretary of the society, Mr. C. W. Canfield, 1331 Broadway, New York, should be addressed. The other officers are Mr. F. C. Beach, president; Mr. W. H. Gilder, vice-president; Mr. J. S. Rich, treasurer.

The recent improvements in photography have almost revolutionized the art, and greatly increased the number of amateur photographers. The old, sloppy, wet plate system has almost passed away; the finest pictures are now taken by means of dry sensitive plates. With a supply of these in hand and a light camera, the lover of nature, wherever he goes, may instantly secure the image of the landscape or other object that attracts his fancy. For the amateur the practice of this art is overflowing with advantages. Not only is the taste for beauty insensibly increased and the mind expanded, but subjects for study and conversation originated; better than all, physical health and strength are gained by the delightful exercise in the open air which picture taking requires.

### Tin Casing to Retard Flames.

The principal cause of the rapid spreading of flames in modern buildings is found in the fact that the elevator shafts furnish such perfect flues for making a strong draught. When, added to this, these openings through the floors of a building, from top to bottom, are incased with wood, alone forms the partition walls separating such a flue from the different stories, it will be readily seen that we have a surprisingly perfect arrangement for the quick spreading of a conflagration from cellar to roof. A cheap and easily obtainable means for partial protection from this danger, in buildings where the most improved construction has not been followed, would be to line the elevator shaft and the connecting doors and casing, as well as the car, with tin. This would not, of course, make these openings proof against the action of a fire which had been some time in progress, where the accumulated heat would be like that of a furnace, but it would interpose a measure of protection which would effectually check a fire in its initial stages, and prevent the sudden flashing into a blaze, through this channel, of all the floors at a time of a great store or warehouse. This is a precaution which may be taken with so little trouble and expense that it is worth the consideration of every owner or occupant of a building where the elevator shaft is of the old style of combustible construction.

### The Art of Thinking.

The object of the teacher is to teach to think. The pupil thinks enough, but he thinks loosely, incoherently, indefinitely, and vaguely. He expends power enough on his mental work, but it is poorly applied. The teacher points out to him these indefinite or incoherent results, and demands logical statements of him. Here is the positive advantage the teacher is to the pupil.

Let us suppose two pupils are studying the same lesson in geography or grammar or history. One reads to get the facts; he fastens his eye on the page and his mind to the subject before him; he makes the book a study and acquires information from it; his object is to acquire knowledge. He attains this end. The other also studies the book, but while reading he is obtaining lessons in thinking. He does not merely commit to memory; he stops to see if the argument is sound, he analyzes it to see if the conclusion is warranted by the premises.

The one who thinks as he reads is quite different, it will be seen, from him who simply learns as he reads. To read and think, or to think as one reads, is the end to seek. To teach to think is then the art of the teacher. The reader for facts gets facts; he comes to the recitation seat and reels off those facts. His mind, like Edison's phonograph, gives back just what it received. While this power is valuable, it is not the power the world wants.

The teacher will find his pupils come to the recitation to transmit the facts they have gained. He must put them in quite another frame of mind. Instead of recitations they must be made into thinkers. The value of the teacher is measured by his power to teach the art of thinking.—*Teacher's Institute.*

### Steam Boiler Accidents.

In giving a summary of the number of boiler explosions in this country in 1883, the *Locomotive* says that "the number of recorded explosions reaches a total of 184, by which 263 people were killed outright, and 412 injured. As many of the latter were reported fatally injured at the time of the explosion, it is probable that the number of deaths considerably exceeded 263. This reckless waste of human life is entirely unnecessary, and might be, to a great extent, prevented by the exercise of even ordinary care and prudence."

The concluding sentence is remarkable: "This *reckless* waste of human life is entirely unnecessary, and might be, to a great extent, *prevented* by the exercise of even *ordinary care and prudence.*" This is strong language, but it is not the unthinking and intemperate outburst of some indignant engineer who is angered at the belittling of his business by pretenders. It is the calm, published statement of a responsible company which keeps a corps of competent men examining boilers, and lives by warranting the life of boilers, or paying for the damage done by their explosions—the Hartford Steam Boiler Inspection and Insurance Co. If this "reckless waste of human life" is in any degree preventable by "the exercise of care and prudence," it is time that some care and prudence were exercised by the legal authorities.

There is, in some States, a superficial examination of engineers to determine their qualifications so far as to ascertain if these are sufficient to give them control of an engine (and presumably a boiler). But even this examination is of the most flimsy sort, if the experience of the writer is a specimen; and as for firemen, any man who can shovel coal and wheel ashes fills that bill, generally. But in most places and cases there is no other recommendation for an engineer and a fireman but that of cheapness. In fact, there are engines and boilers run in our cities without either engineer or fireman.

An economical firm recently put in a boiler and a second-hand engine, having previously hired power. On a visit to the new establishment the boiler was found in a dark cellar, and to see the pump a kerosene lamp had to be lighted. This establishment had no engineer nor coal heaver. When the speed went down somebody was sent to stir up the fire, and, as the principal of the firm said: "We pump in water twice a day." The boiler had a glass gauge and two gauge cocks, but the glass was opaque from dirt, and the lower gauge cock could not be opened by ordinary hand force—it had rusted (oxidized) in its seat.

The *Locomotive* gives a similar instance of ignorant neglect: A boiler insured in the company was found at the first quarterly visit with the safety valve so "jammed" that it could not be moved by manual lift at the end of the lever with a boiler pressure of 100 pounds. It was stated to the inspector that the fireman and engineer was "any one who wanted more steam." The insurance policy was canceled. Not long afterward an "accident," happily without loss of life, compelled a temporary shutting down of the works.

### The Inventor of the Locomotive.

A beautiful memorial window has just been erected in Newburn church to the memory of the late William and Thomas Hedley, the one the inventor of the locomotive engine, who was born at Newburn, and the other his son, the practical founder of the Bishopric of Newcastle. The subjects chosen by the artist are "Noah and his three sons building the ark," illustrating the genius given by God to man, and the parable of the talents, typifying the good use of the genius and wealth that man is blessed with. Above the first group is a scroll with the text, "And thus did Noah according to all that God commanded him," and above the other, "Well done, thou good and faithful servant." The work has been executed by Mr. W. H. Atkinson, of this city. At the base of the window is a large brass plate, engraved by Mr. A. Reid, of this city, bearing the following inscription: "The above window is dedicated by William Hedley, of Newton, in this country, to the glory of God, and in loving remembrance of his relatives interred in the adjoining churchyard, amongst whom are his father, William Hedley, of Newton and of Burnopside Hall, near Lanchester, Esquire; and his brother, Thomas Hedley, barrister-at-law, also of Newton, Esquire. By the inventive genius of the former, the locomotive engine was first brought into successful operation, A.D. 1812 and 1813, at Wylam; and chiefly through the munificent bequest of the latter the Bishopric of Newcastle-on-Tyne was created in 1882." At the bottom of the plate is the representation of a railway engine, and underneath are the words, "Drawing of the first locomotive invented by William Hedley, originally placed in Kensington Museum."—*Northern Evening Express.*

### Indelible Stamping Ink.

E. Johanson, of St. Petersburg, gives the following formula for a convenient ink for marking clothing by means of a stamp: Twenty-two parts of carbonate of soda are dissolved in 85 parts of glycerine, and triturated with 20 parts of gum arabic. In a small flask are dissolved 11 parts of nitrate of silver in 20 parts of officinal water of ammonia. The two solutions are then mixed, and heated to boiling. After the liquid has acquired a dark color, 10 parts of Venetian turpentine are stirred into it. The quantity of glycerine may be varied to suit the size of the letters. After stamping, expose to the sun or apply a hot iron.

### A New Cure for Cancer.

Information of one more remedy alleged to possess special virtues in curing "cancer" reaches us through a correspondent from Brazil. Dr. Ignacio Alcibiades Velloso, of Recife, Pernambuco, introduced the remedy to notice, and in a communication to the *Journal de Recife* gives his experience of its use.

He states that the plant, which is popularly known by the name of the "alvelos," belongs to the Euphorbiaceæ, and is indigenous to Pernambuco. He alleges that a magistrate who was suffering from epithelioma of the face, and who had returned to his estate despairing of relief, was entirely cured of his disease by the topical application of the juice of this plant. Dr. Velloso learning this, was induced to employ the same remedy on two patients at the Hospital Pedro II.--one a case of cancroid of the nose, the other of epithelioma of the lip—with the result that the first patient was "completely cured" in forty days, and the second in less than two months, "much to the surprise of the other professional men of the establishment." Such results, he thinks, justify a trial of the remedy, especially in uterine cancer.

The action of the juice of the plant, as others of the same natural order, is irritating, producing a spreading dermatitis without much pain; and the application of the cut stem or the juice of the fresh plant to the diseased part, is said to result in destruction of the morbid tissue, which is replaced by healthy granulations—doing the work, in fact, of the chloride of zinc paste.

Upon this we need only remark that if the remedy really possess the escharotic action described, there is less reason for doubting its efficacy in such localized morbid formations as those mentioned than there was for questioning the alleged virtues of other remedies, such as "condurango," which flourished for a time, but which were supposed to operate after they had been taken into the stomach. It is clear, however, that the use of the "alvelos" must be limited to the regions in which the plant grows.—*Lancet.*

### Condensed Milk.

Several successful prosecutions have been conducted against the retailers of condensed milk in Liverpool, which the *Analyst* thinks will doubtless cause considerable consternation among the large milk condensing companies, who have up to the present time escaped the operations of the "Sale of Food and Drugs Act."

Condensed milk has been lately extensively employed in connection with what may be called a new industry, that of "milk blending," or in other words, letting down rich dairy milk, so that the analytical results agree with the figures for solids not fat prescribed by the Society of Public Analysts. Large quantities are daily consumed in this way by milkmen, and to such an extent has the trade increased that condensed milk is imported in churns, especially manufactured for the convenience of dairymen; these churns being returned to the factory for a further supply.

The difficulties of condensing rich milk, although much scientific attention has been devoted to it of late years, are well known to those engaged in the trade, more especially when the milk is preserved without the addition of sugar, but there is now no difficulty whatever in preparing condensed milk of fair average quality containing the whole of the cream present in the milk previous to condensation. The excuse that a large proportion of the fat was mechanically carried over in the operation of condensing *in vacuo* has been repeatedly proved to be erroneous. In fact, it is not unusual to add to the milk, during the first stage of concentration, clear butter fat, in order to prevent the excessive frothing which takes place and causes considerable trouble, requiring great care to prevent the milk from rising over and mixing with the condensing water.

Manufacturers of condensed milk have, therefore, no more right to deprive the milk of its cream previous to condensation than the ordinary milkman; in fact, the offense becomes in their case more serious, as, instead of declaring the article as condensed skim milk, it is described as milk, guaranteed to be pure cows' milk, and is highly recommended for invalids' and infants' diet, as being more wholesome and nutritious than fresh cows' milk, and especially milk from cows fed in cowsheds in large towns; the milk is the richest and best, the water having been abstracted and pure loaf sugar added. The heinousness of selling condensed skim milk under cover of this guarantee is obvious, more especially as the offense is not committed by a small milkman in one of the poorer districts of our large towns, but by large companies, presumably with extensive capital and controlled by educated men, who, simply for the sake of underselling, put forward an article deprived of one of its most valuable constituents, and represent it to be richer in quality than genuine milk from cows fed in cowsheds in large towns.

### Analysis of Chrome Iron Ores.

The insolubility and infusibility of chromic iron render its analysis one of the most tedious. Schwarz recommends smelting the finely pulverized mineral with chlorate of potash and caustic potash, in a silver crucible. The fused mass is dissolved in water, and the quantity of potassic chromate estimated by running in a solution of ferrous sulphate, then titrating the excess of the latter with permanganate solution. The residue insoluble in water is dissolved in hydrochloric acid, and the iron titrated with stannous chloride. A good silver crucible will stand one hundred fusions.

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## Correspondence.

### Calming the Waves with Oil.

*To the Editor of the Scientific American:*

In looking over some odd volumes of the *Penny Magazine,* an old London weekly, I came across a paragraph "On the effect of oil in stilling waves." This article is contained in the issue of May 28, 1842, a testimony of Sir Gilfred Lawson, "who served in the British army at the defense of Gibraltar. He relates that the fishermen of Gibraltar were accustomed to pour a little oil on the sea, in order to still its motions, that they might be enabled to see the oysters lying at its bottom; Sir Gilfred had often seen this done." . . . "Dr. Franklin was informed that many of the divers on the coast of Italy were accustomed to take a little oil in their mouths before they dived; when they had descended to a certain depth they allowed the escape of the oil, which, rising to the surface by virtue of its lightness, spread in a thin film, which smoothed the water ripples and allowed light to descend to a considerable depth. The fishermen of Lisbon, when about to return into the river, if they saw before them too great a surf upon the bar, were accustomed to empty a bottle or two of oil into the sea, to still the breakers."

Franklin thus narrates: "In 1757, being at sea in a fleet of ninety-six sail, bound against Louisbourg, I observed the wakes of two of the ships to be remarkably smooth, while all the others were ruffled by the wind, which blew fresh. Being puzzled with the differing appearance, I at last pointed it out to our captain, and asked him the meaning of it. 'The cooks,' said he, 'have, I suppose, been just emptying their greasy water through the scuppers, which has greased the sides of those ships a little!' and this answer he gave me with an air of some little contempt, as to a person ignorant of what everybody knew. In my own mind I at first slighted this solution, though I was not able to think of another."

Franklin did not drop this subject, but conversed with "maritime men" on the matter, and found that most of them knew of it. He made some experiments on Clapham pond, but found that if applied upon the leeward side of the pond, where the waves were largest, the oil was driven upon the shore. But on dropping a teaspoonful of oil on the windward side, it produced a "sudden calm over a space of several yards," until it gradually made the pond of perhaps half an acre, "as smooth as looking glass." He explains it thus: "I imagine that the wind blowing over water thus covered with a film of oil cannot easily *catch* upon it, so as to raise the first wrinkles, but slides over it, and leaves it smooth as it finds it. It moves a little the oil, indeed, which, being between it and the water, serves it to slide with and prevents friction."

A. L. R.

Fort Wayne, April 2, 1884.

### Substitutes for India Rubber and Gutta Percha.

The Swiss *Gewerbe-blatt* thus discusses the subject of a substitute for India rubber. In the first place, such a substitute must be cheaper than real India rubber. There are many kinds of material that fulfill this requirement. Sulphur is one of the things that is unattacked by acids, alkalies, and salts. Its great brittleness gives place to a softness, pliability, and elasticity similar to rubber if it is poured into cold water while melted. (It melts twice at different temperatures, and it is only after this second melting that it possesses this elasticity.) It remains soft enough to be moulded for several days, and these qualities it retains permanently if it is mixed with more or less linseed oil varnish before it is poured into water.

There is no doubt that sulphur is of importance in making artificial substitutes for India rubber, and no less so as a substitute for gutta percha. The first thing is to endeavor to discover some permanently elastic substance which shall destroy that crystalline structure which makes the sulphur brittle, and render it impossible for it to return to this condition.

Next after sulphur, alumina soap deserves consideration, for it is likewise a tenacious substance that can be stretched, and it undergoes many curious changes when melted with thick linseed varnish and resin. Zingler has, in fact, patented a composition of sulphur, copal, oil of turpentine, and albumen.

Although substitutes for gutta percha may be obtained with the aid of some of these substances, it will always be difficult to imitate the elasticity of India rubber, so that its substitutes will find use only where its elastic property does not come into prominence.—*Poly. Notizblatt.*

### Artesian Wells on the New Jersey Coast.

Dr. George H. Cook, the New Jersey State Geologist, describes the successful opening of artesian wells, 400 feet deep, at Ocean Grove and Asbury Park last summer, and says the character of the sand and marl found in the boring is so well marked that it may be reasonably expected to yield water for the supply of all the towns and villages on the sea coast. The water is absolutely free from contamination with organic matters, and is soft enough for laundry purposes. The well at Ocean Grove is a flowing well, yielding 60,000 to 70,000 gallons daily; it is lined with six inch iron tube for 50 feet, the bore lower down not being tubed. The water has a temperature of 60° F., and contains 8·5 cubic inches of carbonic acid per gallon.

### Siphonage of Traps by Capillary Attraction.

A correspondent of the *Hydraulic Plumber,* of New York, relates a story of his employment, some time ago, to investigate the causes of a foul smell in a certain bath room, where other plumbers had worked before him in vain. The pipes had been swabbed out; the closet, an old-fashioned pan apparatus, had been burned out, and disinfectants applied in vain. The wastes of bath and wash basin, according to the old practice, entered the water closet trap, but no sign of leakage could be discovered about this or the waste pipes. The new plumber, not knowing what else to look for, removed the closet and filled the trap with water. As soon as the agitation had ceased, he measured the depth of the water, and then left it to itself for twenty minutes. At the end of that time the water level had fallen half an inch. Twenty minutes later it had fallen still more, and in an hour the seal was so far broken as to allow a slight current of sewer air to enter the room. The plumber then left the room for two hours, locking the door and taking the key with him. When he returned the place was full of foul air, and on passing his hand under the bend of the trap he found a space of about an inch and a quarter between the surface of the water and the under side of the bend of the trap.

The next step was to cut away the crown of the trap, so as to expose the upper portion of the bend. An opening was made, 4 inches long and 3½ inches wide, but examination through this showed nothing out of the way until the trap was refilled, when a wet line was observed over the bend, which proved to follow the course of some hairs, twelve or fifteen in all, which had been caught, together with some lint and ravelings, in the slimy lining of the bend. By detaching the lower part of this collection from the walls, allowing it to hang down free in the outlet pipe, the water was observed to drip from the end at the rate of 70 or 80 drops a minute. The whole was then cleared away and the closet replaced, and no more trouble was experienced.

The plumber in question then made some very interesting experiments, to ascertain the amount of conducting substance necessary to cause the emptying of traps in this way, using a small beaker glass in place of a lead trap. He found that with five pieces of No. 80 spool cotton, about 7 inches long, hung over the edge of the beaker, the water level was lowered 3 inches in nineteen hours, and ½ inch in about fifteen minutes. With five long hairs the lowering amounted to 1 inch in ten hours, and 3 inches in about a day and a half. With five hairs and two threads, of the same size as before, the lowering in seven and one-half hours was 1½ inches. One piece of cotton twine lowered the water ¾ of an inch in four and one-half hours. Two pieces of twine drew over 1 inch of water in two hours, and 2 inches in less than four hours. A bit of cotton cloth, half an inch wide, siphoned over ¾ of an inch of water in an hour and a quarter. There was apparently no difference in the action, whether the threads were submerged or floated on the surface of the water.

In the sunshine the drying of the absorbent material was so rapid as sometimes to stop the capillary action, but in the shade it went on steadily, even when the beaker was placed in a strong current of warm air. As nothing is of more common occurrence in drain pipes than lint or hair, it seems likely that this observation will explain many cases of offensive odors in bath rooms and bed rooms not otherwise to be accounted for.

### Siemens, Bessemer, and the German Patent System.

It is related that the late Sir William Siemens, who was born and educated in Germany, but made England his home after his twenty-fourth year, was principally moved to change his residence from the greater security afforded inventors by the English patent law. The English patent law was not then (1844) as liberal as it now is, but the advantages thereunder were greatly superior to those afforded in Germany, where great inventions had been often refused any protection, while inventors of small mechanical improvements were allowed patents for only a short period.

The early German policy was well illustrated in the manner of treating the Bessemer process. Before Sir Henry had taken the preliminary steps to obtain his German patent, Herr Krupp had entered into negotiations therefor, and agreed to pay £5,000 for the use of the invention. The inventor accordingly sent all his papers to Krupp, who in due course applied to the Prussian Government for a patent, and was told the invention was not a new one, but that Mr. Nasmyth had made the invention previously. Mr. Nasmyth denied this, and the Prussian officials of patents then said some one else had made the invention, and they would find out in a few days who it was. This excuse continued to be made during six weeks, during which the Commissioners promised from day to day to find a previous inventor, when they finally told Krupp: "If we do not find it to-morrow, we will grant your patent." This answer was then again repeated until a week of to-morrows had passed, when, as Krupp called the last time, he was shown an English blue book, containing the publication of the English patent, and the Commissioners said: "Now, seeing it is a publication in Prussia, we cannot grant you a patent by the law of Prussia." Of course, after this answer Herr Krupp had the use of the invention without any legal obligation to make any payment to the inventor.

### The Old Trade Guilds in Germany.

The late Sir William Siemens, who was born in Hanover in 1823, and received his early education at Lubeck, has thus described the manner of "learning a trade" at that time in vogue:

"When a boy at school," he says, "I was living under the full vigor of the old guild system. In going through the streets of Lubeck I saw Carpenters' Arms, Tailors' Arms, Goldsmiths' Arms, and Blacksmiths' Arms. These were lodging houses where every journeyman belonging to that trade or craft had to stop if came into the town. In commencing his career, he had to be bound as an apprentice for three or four years; and the master, in taking an apprentice, had to enter into an engagement to teach him the art and mystery, which meant the science of his trade. Before the young man could leave his state of apprenticeship he had to pass a certain examination; he had to produce his *Gesellen-stück,* or journeyman piece of work, and if that was found satisfactory he was pronounced a journeyman. He had then to travel for four years from place to place, not being allowed to remain for longer than four months under any one master; he had to go from city to city, and thus pick up knowledge in the best way that could have been devised in those days. Then, after he had completed his time of travel, on coming back to his native city, he could not settle as a master in his trade until he had produced his *Meister-stück,* or master-piece. These masterpieces in the trade were frequently works of art in every sense of the word. They were, in blacksmithy, for instance, the most splendid pieces of armory; in every trade, and in clocks above all others, great skill was displayed in their production. These were examined by the Guild Masters' Committee, and upon approval were exposed at the Arms of the Trade for a certain time, after which the journeyman was pronounced a master; he was then allowed to marry, provided he had made choice of a young woman of unimpeachable character. These rules would hardly suit the taste of the present day, but still there was a great deal of good in those old guild practices." This system was abolished in Germany in 1869, but the stimulus it afforded to excellence of workmanship appeared to have made an early and lasting impression on his mind.

### Rusting of Iron and Steel.

M. Gruner has lately published in *La Metallurgie,* the results of a year's researches into the comparative oxidizability of cast iron, steel, and soft iron, under the influences of moist air, sea water, and acidulated water. Having done justice to the earlier labors of Mr. Robert Mallet, of Dublin, and Messrs. Phillips and Parker, of London, he explains the arrangements made to secure a perfectly fair trial. The following results were obtained. The experiments with moist air are still proceeding; but so far, it was found that in twenty days the steel plates lost from 3 gram. to 4 gram. for every two square decimeters of surface. Chrome steel rusted more, and tungstated steel less, than the ordinary carbureted steel. Cast iron lost only about half as much as the steel, and spiegeleisen less than gray iron. Sea water dissolves iron rapidly, and acts upon it more powerfully than on steel, most powerfully of all upon spiegeleisen. In nine days the steel plates with 2 square decimeters of surface lost from 1 gram. to 2 gram., while the Bessemer metal lost 3·5 gram., phosphorized iron 5 gram., and spiegeleisen 7 gram. Tempered steel was less affected than the same steel twice annealed, soft steel less than chrome steel, and tungstated steel less than the ordinary steel with the same proportion of carbon. It is evident from these experiments that manganese sheets ought not to be used on the hull of a vessel. Acidulated water dissolves cast iron much more rapidly than steel but not spiegeleisen.

### A New Fire Tank.

Several large fires in the lower part of New York city have demonstrated that the supply of water from the hydrants is insufficient for the purpose. To overcome this evil one of the Fire Commissioners has invented an apparatus which seems to be well adapted to its work, where circumstances require and conditions permit its use. The device consists of a large tank, mounted on wheels, which is supplied with water pumped from fireboats situated in the river. In the trial the tank was placed a mile away from the boat, and the two were connected by hose. The pumps of the fireboat threw water into the tank without trouble, and the fire engines drew from the tank as successfully as from a hydrant.

### The Patent Bills Analyzed by "Puck."

"The Register" in *Puck* dissects the patent bills now before Congress, and draws the following apt conclusions and illustrations: "If these bills go through, the next edition of Webster's Dictionary ought to define 'Legislation' as 'robbery by representatives.' Suppose a bill were introduced to shorten the term of all railroad company charters to five years—a melodious outcry there would be, wouldn't there? But rob the inventor of a patent car wheel of twelve years' profit on his invention, and you find only six men in the House of Representatives to see the iniquity of the proceeding—six out of one hundred and twenty voting. Truly, the age of pure reason has not dawned yet; and there is not so vast a distance between prehistoric man and the dude as the dude's shirt collar would imply."

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### Borax Lake.

In speaking, recently, of boracic acid and its possible sources of origin, we mentioned the Sulphur Bank on the northern side of Clear Lake, in California. South of this, at a distance of less than a mile, is another spot which displays an immense outpouring of boracic acid, though here the emission has been only in times long past, and the acid has all entered into combination with soda, as the name above given indicates.

Borax Lake is very insignificant in its appearance, but fifteen years ago it completely revolutionized the borax trade of the United States, though of that we do not propose to speak to-day. It seems absurd to give the title of lake to it, for it is only a large pool of shallow water, with muddy shores and bottom, and without either inlet or outlet. The length of this oval "mud hole" varies with the season. At the close of the dry season the water has sometimes, though not commonly, entirely evaporated, leaving only a space of mud incrusted with salts, while after an extremely wet season the water is five or six feet deep in the middle, with a length of a mile and a half. This water, even in its most diluted condition, is intensely alkaline, its strength, of course, increasing with the progress of the summer's evaporation.

It is separated from the Sulphur Bank by a ridge somewhat over six hundred feet in height, and the two localities have apparently no relations, the one with the other. The ridge is composed of volcanic materials, scoriæ, obsidian, pumice, etc., and is continued in horseshoe form around three sides of the lake, leaving the southeastern end open.

There is no evidence of a crater having ever existed here, and yet the water plainly occupies a cup-like cavity of unknown depth, for the bottom is filled with an exceedingly smooth and plastic mud, which has been bored to the extent of thirty feet without reaching its lower limit or finding any change in its character, and explorations show that it steadily deepens from the shore toward the center. When the depth of the water is four feet, which may be reckoned a fair average, and which gives a length of about three-quarters of a mile, it holds in solution 18·75 grains of salts to the fluid ounce. These are salts of soda, in the following proportions: Sod. carbon., 0·618; sod. chlorid., 0·204; sod. bibor., 0·178. Each gallon of the water, therefore, holds about a quarter of a pound of borax.

This amount, however, is of small consequence in comparison with that which lies in crystals below in the mud. The change from water to mud is very gradual, the upper portion being semi-fluid. In this part no crystals are to be found. At the depth of perhaps a foot, when it has acquired sufficient consistency to be called liquid mud, the fingers in rubbing it can detect what feels like very fine "grit." This, when washed clean, shows under the microscope, of course, its true nature, and every particle is seen to be a most exquisitely beautiful crystal of pure borax. Going still deeper, the "grit" becomes "sand," for the crystals have become larger and are manifest to the eye, without assistance. As the mud becomes firmer the crystals become larger, being at the depth of two feet a quarter to half an inch long.

At the depth of three to four feet the mud suddenly changes its character. Above this it has been of a grayish-brown, some of it inclining to reddish, which ceases abruptly, being replaced by a firm, tenacious blue clay, the plane of distinction being as sharply marked as that of a course of brick upon stone. In this upper mud the crystals had been gradually increasing in size as the depth increased, until in its lower part they were from an inch and a half to two inches long. Every crystal was distinct and perfect in itself, and—a most wonderful feature—though often lying in contact, they were not adherent.

This last item is very difficult of explanation. We have in unnumbered instances seen them as the mud was removed lying in "layers" or "pockets," from one to ten pounds of separate crystals of the borax lying in one mass, as clean and free from mud as though they had been washed, and as loose and distinct as pebbles on a beach. Each crystal had its own existence. These "layers" were never uniform, and were scattered without apparent order, the adjacent mud often showing no crystals whatever.

When the "blue clay" is reached all this ceases, and crystals of a new style commence. Each one lies by itself, in a firm matrix, from which it can be picked out like a bullet from its mould. They have an individual appearance *sui generis*, so that it is easy to distinguish even the smallest of them from the largest of those in the mud above. But their chief feature is their size. We have taken out many of them which weighed more than a pound each, and a "blue clay" crystal of less than a quarter of a pound seldom occurs. But they cease about as abruptly as they commence, for they are confined absolutely to the upper two feet in thickness of the clay. Abundant examinations have shown that below that no crystals of any sort exist. The mud however continues to be of the same look and quality to the greatest depth reached (thirty feet), and though showing no crystals it holds everywhere a uniform amount of the salts of soda, being sixteen per cent. of its entire weight when dried. The proportions vary somewhat from those of the water above: Sod. carbon, 0·554; sod. chlorid., 0·164; sod. bibor., 0·282. We will show at another time the manner of obtaining the crystals. It was done in sections of four feet square, and we have often seen 900 pounds taken from that extent of the mud; and from the imperfection of the manipulation a large amount, certainly not less than a hundred pounds, escaped back into the lake.

We pass all other points at the present time, barely to consider the enormous quantity of boracic acid which we have here represented. Taking the data just given, the borax held in the water, the tangible crystals down to their lower limit in the upper part of the "blue clay," and the amount contained in the clay below that down only to the distance of which we have knowledge, it is perfectly safe to say that Borax Lake held, and holds how, not less than 9,400,000 pounds of borax to the acre of surface. The ground so rich in crystals does not extend over all the area, but at least twenty-five acres (and this is far within the reality) will come up to our estimate, and we have thus clearly over 200,000,000 pounds there existing.

The mode of its formation we will see later, but whence could this boracic acid have come? Here is a cavity like a crater, though its volcano is not apparent. Admit that the cup was filled with mud rich in soda and that jets of boracic acid were injected below. The space occupied by the jets was manifestly quite restricted, for the acid did not in its full force reach laterally even to the crater's border, and yet they came strong enough and long enough to combine with the soda to the amount we have given. But the *amount* of work done is the least surprising part, as we will see.

### The Walled Lakes of Iowa.

The questions whether the so-called "walled lakes of Iowa" are the work of some extinct race or are natural formations, have periodically appeared for discussion. In his "Geology of Iowa," Prof. Charles A. White presents as a theory that in the shallow portions of the lakes the ice along the shores freezes fast to everything upon the bottom, whether sand, gravel, bowlders, or mud, and the expansive power of the water in freezing is exerted upon them, acting from the center of the lake in all directions toward its circumference. By this means whatever substances are frozen into the ice are pushed up upon the shores as far as the expansive force is exerted, and there left as the ice melts in the spring. By this means embankments have been formed, varying from 2 to 10 feet in width and from 5 to 20 or 30 feet across. The ice, during long ages, has brought these materials together in this manner, having in some instances moved large bowlders and piled them up with other materials.

In corroboration of this, a writer in the *Sun* states that he has "seen the ice piled up on the shores of Walled Lake, in Wright County, pushed up along these embankments, and containing earthy materials of which the walls are made. Occasionally these walls were found along the old margin of some dried-up prairie slough, proving the existence of an open shallow lake in some time past."

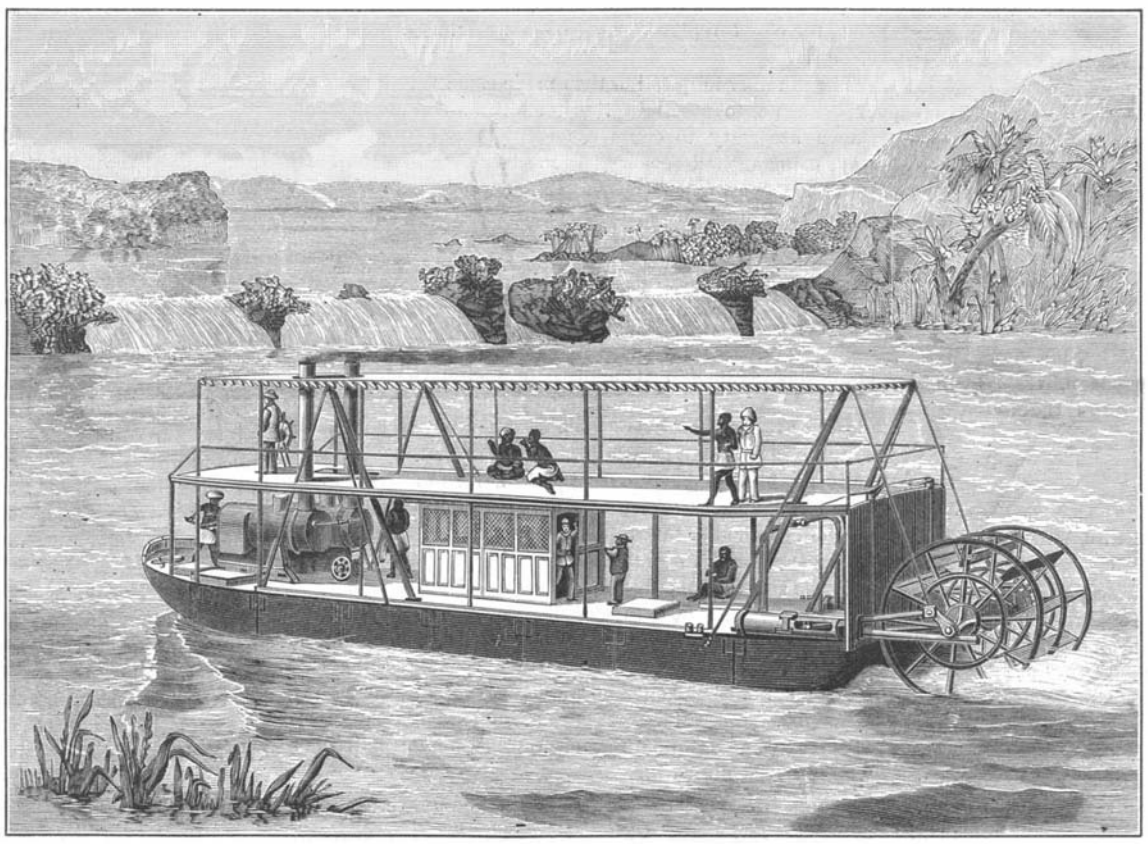
### American Car Wheels.

"There are more than 10,000,000 iron car wheels in use on American railroads," said the master mechanic of one of the trunk lines, "and it requires about 525 pounds of pig iron to make one wheel. About 1,250,000 wheels are worn out every year, and the same number of new ones must be made to take their places. The iron men are called upon for only a small proportion of the 312,500 tons of material required for these new wheels, however, for nearly 290,000 tons are supplied by the worn out wheels themselves. Formerly, the life of a car wheel was estimated at eight years, but the reduction of the railroads generally to the standard gauge, and the improvements in loading and unloading facilities, have materially decreased the length of service that a wheel may be depended on to perform. The uniformity in gauge keeps cars in more continuous use, while the decrease in time of loading and unloading enables them to be put to more active service even where they are run only on short local routes.

"These figures do not include the wheels on palace coaches and the better class of passenger coaches. The wheels on that grade of rolling stock are for the most part what are known as paper wheels. That is, the wheel is made with steel rim or flange and iron center or hub, but the filling or web between hub and rim is composed of sheets of paper cemented together. They are as serviceable as the wheels of solid iron, and combine lightness with strength—a great desideratum where speed and economy in motive power are of paramount importance."

### THE SECTIONAL STEAMER LE STANLEY.

A river run was lately made in the Thames with a small vessel of peculiar construction, and for a purpose which may some day single it out as one of the steamers with an epoch-making history. Le Stanley is the name given to this small steamer, in honor of the celebrated African explorer. She has been built near London, under the inspection of Monsieur Delcourt, Chief Engineer of the Belgian Government, for L'Association Internationale, of Brussels, of which the King of the Belgians is the head. It is an association having for its object the opening up to commerce and civilization of the unknown regions of Africa, said to be wholly without political aim, and what it is doing must therefore be looked upon as for the universal good. Mr. Stanley, who is engaged establishing numerous stations, is the head of the expedition in Africa; the little steamer is to assist him in his operations, especially in the district of the Congo and its tributaries; and some idea of the magnitude of an expedition of this kind may be formed when it is stated that no less than 500 natives have already been engaged to accompany the steamer and assist in its transport overland. About the middle of last year the Belgian authorities placed themselves in communication with Messrs. Yarrow & Co., with a view to build a thoroughly serviceable steamer of exceptionally shallow draught and able to steam in places where there is not water sufficient for vessels constructed in the usual way. The main point, however, was to design something that could be easily transported overland, so as to pass by and avoid the numerous rapids and cataracts which render navigation impossible. With these requirements before them Messrs. Yarrow & Co. have constructed the present steamer; it consists of six galvanized steel square-shaped pontoons, 18 feet long by 8½ feet wide by 4 feet deep; these sections, each of which is watertight and therefore floatable, are placed side by side; to these are added a bow piece and a stern piece, making together a hull 70 feet long by 18 feet beam. By means which we shall describe at more length at another time these sections can be readily united and disunited, and this can be done afloat. On the bow division are placed two boilers, and on the stern division the engines, which are designed for a working pressure of 140 pounds per square inch, and have cylinders 10½ inches in diameter by 2½ feet stroke, which, by means of a crank on each side, drive a paddlewheel situated aft, well clear of the stern. The engines are each made up on a steel tube as a frame. The strain due to these weights being concentrated at the extreme ends of the boat is taken by a system of light steel tie rods above, secured to tubular king posts; the effect of this system is at all times to throw a compression on the hull, thereby tending to keep the various sections together in close contact and free from alternating strains. Above the vessel, and completely covering it, is a wooden awning deck, which in an African climate is very necessary to protect the passengers and crew from the sun. The boilers are made with very capacious grates, and



STERN WHEEL SECTIONAL STEAMBOAT, LE STANLEY FOR AFRICA.

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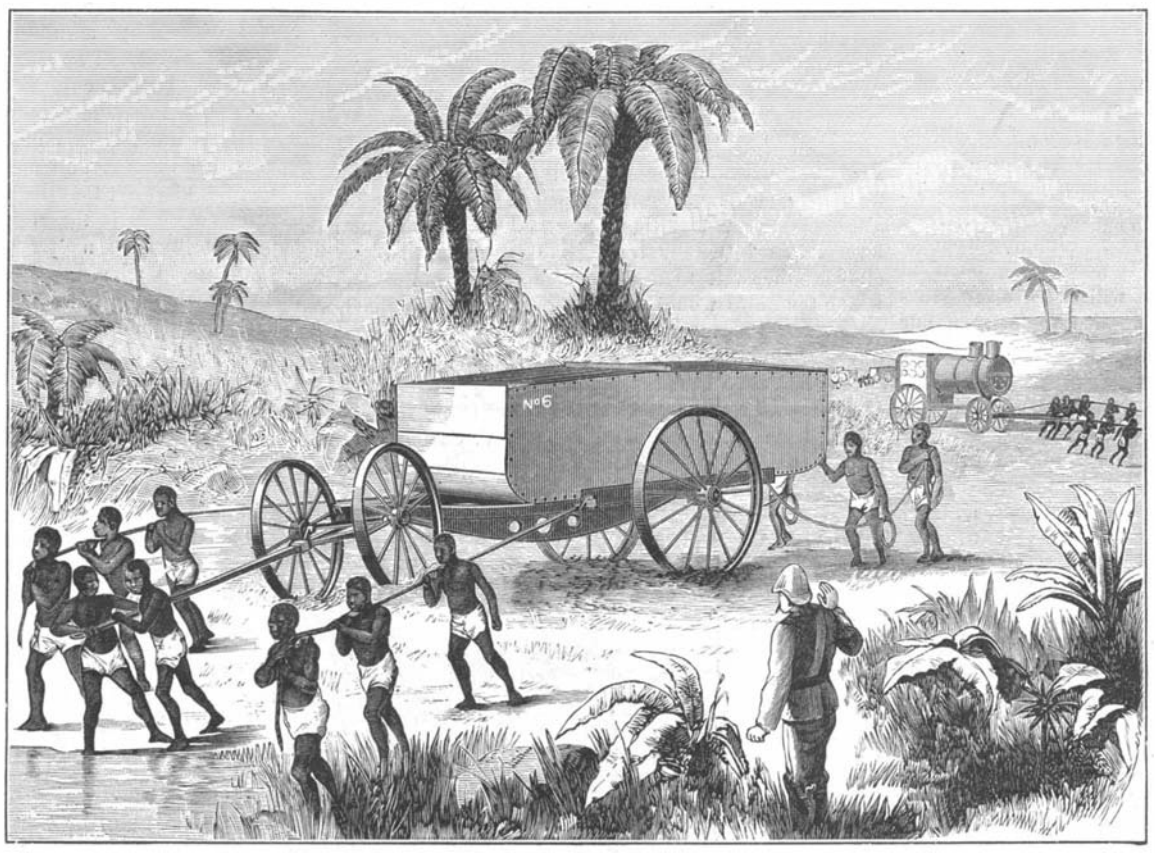
of course wood is the only fuel procurable, and will not always be the driest and best adapted for making steam.

It is intended to ship this steamer, in her several sections, direct to the mouth of the Congo, where she will be put together afloat, which, it is contemplated, will not occupy more than twenty-four hours. She will at once proceed, under her own steam, as far up the river as it is navigable; then be taken to pieces for transport overland; and in this operation will be seen one great novelty in her design. After the machinery is removed from the deck the hull will only draw 6 inches; it is then brought into exceedingly shallow water, and the operation of disconnecting the various sections proceeded with. To each section while still afloat will be secured four large light steel wheels having very wide tires. This being done, the divisions are ready to be hauled out of the water and over land, and what was once a section of a boat now becomes the body of a wagon of ample capacity to convey the lighter portions of machinery and stores. On arrival at the next navigable part of the river, these wagons so constructed are run into the water, the wheels are removed and the various divisions reunited, forming again an entire vessel. In this way the journey can be continued, the steamer being taken to pieces and put together as often as circumstances require.

At the preliminary trial the vessel went through numerous maneuvers; the mean draught was 14 inches in working trim, and with a steam pressure of 100 pounds per square inch a speed of nine and a half to ten miles an hour was obtained—an excellent result, taking into consideration the proportion of length to beam and other peculiarities of the craft. Great steering power is of course necessary, and the most striking performance was the marvelous facility with which the boat could pivot on a center only a little within a point a few feet from the stern, which was very remarkable, and clearly rendered this type of steamer admirably suited for tortuous and winding rivers. On the deck is a small, well ventilated saloon, and the steering wheel is placed high up on a bridge some 12 feet above the water, giving the pilot a good view all around.

It would seem to us that this system of construction, namely, that of uniting together a number of floating sections so as to form a vessel of moderate and useful dimensions, and of good carrying capacity, opens up a new field, as the difficulty hitherto experienced in the development of trade with Africa has been due in a great measure to practical difficulties in placing vessels of light draught on the rivers.




MODE OF TRANSPORTING THE SECTIONS OF THE STEAMER.

### The Florida Everglades.

A correspondent of the *Boston Journal* thus speaks of the drainage work already accomplished in the Florida Everglades, under the direction of Capt. R. E. Rose: "From Sanford, on the St. Johns River, the Florida Central Railroad brought us through 40 miles of incipient towns with winter hotels to Kissimmee on the edge of Lake Tohopekaliga, which is near the upper level of the great swamp region. Imagine a shallow basin from 30 to 50 miles wide and 150 long, sloping slightly to the south and divided by low dams across it into shallow ponds or lakes, slowly oozing and overflowing from one to the other until the whole is lost by evaporation in the Okeechobee Swamp. Canals 40 feet wide and of a depth increasing as the water lowers, have been cut from one lake to another, the Kissimmee River channel almost made anew, and the great swamp connected by direct channel with the Calobahaichie River, emptying into the Gulf. A steamboat 130 feet long and 30 feet wide, lying here at the wharf, has come from New Orleans across the Gulf and up the artificial canals. The work of cutting has been done by endless chains armed with buckets, lifting the earth from the bottom and discharging on each side, and working down stream and then back again until the requisite depth is obtained. So that the first boat, all the materials of which were hauled here by ox teams or cut from the surrounding forests, has actually dug its way to the sea. The lake in front of us has already been lowered seven feet, turning from impassable morass into arable land about 150 square miles. I have seen sugar cane growing where two years ago the first dredge boat came to anchor."

IN the opinion of the *Medical Press*, most physicians are very decidedly in favor of the total abolition of corporal punishment in schools. The editor asserts that the London University College School, which is attended by 500 boys, has been carried on from the first without corporal punishment, and is equal to any school in England with respect to discipline.

### The Matrix of the Diamond.

Until the South African mines were discovered the diamond was always found in sands and gravels, different from the mineral in which it was believed to be formed. At Griqualand West, however, the consolidated eruptive mud of the mines was believed by some to be the true matrix of the diamond; but opinions differed on the question, and arguments were found on both sides. M. Chaper, a French geologist, has, however, during a scientific mission to Hindostan, succeeded in finding the diamond in its mother rock. At Naizam, near Bellary, in the Madras Presidency, M. Chaper has found the diamond in a matrix of rose pegmatite, where it is associated with corundum. The tract of country is almost denuded of trees, bare and rocky, and the rains wasting the rocks, every year expose fresh diamonds in the soil. The rock is traversed by veins of feldspar and epidotiferous quartz. Here the diamond is always found, associated with epidotiferous rose pegmatite. The diamond crystals observed are octahedral, but less distinct in line than the stones of South Africa, which seem to have been formed in a freer matrix. It follows from M. Chaper's discovery that diamonds may exist in all rocks arising from the destruction or erosion of pegmatite, for example, in quartzites with or without mica, clays, pudding stones, etc.

### Time by Telephone.

A lawyer whose office is in the Leffingwell building stepped up to his telephone one morning, watch in hand. He did not ring or talk into the transmitter, but listened intently for several seconds with the tube at his ear, and his eyes fastened upon the face of the watch. "Just ten minutes past 11 o'clock," he remarked, as he returned the watch to his pocket and hung up the tube. "I am precisely half a minute slow."

Only a few of the local telephone subscribers are aware of the fact that they can ascertain the correct time by simply listening at their telephone instruments. A clock apparatus has been connected at the central office with all the circuits, by which there is given at the end of each minute the hour of the day and the number of minutes past the hour. The beats signifying this are distinctly audible, although not loud enough to interfere in any degree with conversation. The attachment of this time apparatus explains the ticking sound which has mystified many persons within the last few days. The apparatus is not connected with the clock in the Yale Observatory, although it is regulated by the observatory standard.

Manager Fairchild, of the Telephone Company, said: "The apparatus was put into the office Monday by way of experiment. It is worked by batteries, and gives the hour and the minute simultaneously over all our circuits. To ascertain the precise time it is only necessary to step to your instrument. At the end of every minute there is clicked off the hour and then the number of minutes which have elapsed since the hour was struck. If it happens to be thirteen minutes past there is one beat, then a short pause, and then three more in quick succession. The attachment works successfully, and the only question about retaining it is the cost. The expense will be about $1,000 a year, and if our subscribers are willing to pay for the accommodation they can have it."

"But suppose the subscribers on some of the circuits are willing to pay and those upon others are not?"

"We can render it useless on any given circuit by putting on an attachment called the confuser. This mixes up the beats so that no one can tell what they mean."—*New Haven Register.*

### How to Attain Old Age.

The Psalmist David allowed seventy years as the natural duration of life, Pythagoras placed the limit at eighty, London's hygienic philosopher, Dr. Richardson, gives us ten more, while Flourens believed that man ought to live one hundred years.

There is no doubt that the physiological limit of human life has been slightly increased in the present century, and a hundred years later it may be found that old age comes on still more slowly and gently. For, with the increased uncertainty as to a future life, human energies are directing themselves with greater earnestness toward solving the problems of a more healthful and longer terrestrial existence.

The physiological chemist tells us that after the age of forty or forty-five, disassimilation gradually begins to exceed assimilation, and the structures of the body slowly waste. Muscle and nerve, which are the "master tissues," feel this first. The dynamic coefficient of both striped and unstriped muscle decreases after forty; the limbs become less supple, and the hollow viscera have a feebler expulsive force; the nervous system is less sensitive and plastic; impulses travel between center and periphery with more difficulty. The individual loses spontaneity, and becomes more automatic, more a creature of determined habits.

The lower tissues also undergo very marked and characteristic changes. The fibrin-factors of the blood increase in amount, the bones become drier, the cartilages ossify, and the arteries especially become the seat of fatty degeneration and calcareous deposits.

Dr. Richardson announces that "his experiments show" that the colloidal matter (protoplasm?) of the body in old age contains less water, and that its particles are consequently more cohesive. It is true, at any rate, that the total amount of water in the body is less.

The essential fact as regards senile changes is that the metabolic function is weakened. Consequently the food, instead of being built up into good tissue, is oxidized into less complex substances. The protoplasm turns out fat instead of new protoplasm, the circulatory apparatus becomes weaker, the blood stagnates, carbonic acid precipitates, and earthy salts, which it kept in solution, are deposited.

Now, certain recent philosophers have thought that, by preventing these fatty and calcareous changes, old age could be delayed. A Swiss physician, a few years ago, argued that lemons, *i. e.*, citric acid, would accomplish this end, and saw immortality in lemonade. More recently, a writer in *Knowledge*, Mr. W. O. Dawson, has presented a new *regimen sanitatis*, which he claims is the most rational and certain means of retarding old age. It consists in avoiding all food rich in earthy salts, and in taking, daily, two or three tumblerfuls of distilled water with ten or fifteen drops of dilute phosphoric acid in each glassful. The food freest of earthy salts is: fruits, fish, and poultry, young mutton and veal.

We can testify with Mr. Dawson that this kind of diet is harmless, but we are profoundly skeptical as to its efficiency.

Old age is part of the life history of the organism. There is that in the child at birth which determines very nearly when old age shall appear. Senility is a failure of nutrition. We can only delay its appearance by living a life which puts no undue strain on the organism, and by furnishing it with the easiest means of working. We cannot expect to accomplish this end simply by cutting off certain deleterious supplies. If one would live long, let him especially take care of his "master tissues"—the muscle and nerve—when young. This means rational exercise of body and a well balanced cultivation of mind. Brain workers live long, brain and muscle workers longer still. No one has yet given better advice for the retarding of old age than did Christopher Hufeland, a century ago. Let those who wish old age study him, and put no trust in distilled water.—*Medical Record.*

### To Prevent Scratching Matches on Paint.

A correspondent in Florida, of *New Remedies*, speaking of the defacement of paint by the inadvertent or heedless scratching of matches, says that he has observed that when one mark has been made others follow rapidly. To effectually prevent this, rub the spot with flannel saturated with any liquid vaseline. "After that people may try to strike their matches there as much as they like, they will neither get a light nor injure the paint," and most singular, the petroleum causes the existing mark to soon disappear, at least when it occurs on dark paint.

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### The Decay of Westminster Abbey.

The atmosphere of London has played havoc with the stone in this famous building, and although the interior is in good condition, beneath the coating of grime and dirt with which long ages have covered the structure, and which conceals the decay from the eye of the casual observer, there has been long going on a process of decomposition which, if not arrested, will speedily cause ruin. The London *Times* states that in 1882 a well known architect examined and reported upon the condition of the Abbey. The wall surfaces round the clear story windows, wherever the fire stone has been allowed to remain, have become very seriously decayed, the decay in some places penetrating to a depth of seven or eight inches, "so that the architect is surprised that the heavy cornices and parapets should have found a sufficient support in so ruinous a wall." Before the report was made, in some of the worst places in the nave, the superstructure had been removed and the face of the wall rebuilt; but the architect was of the opinion that "immediate and very extensive repairs and restorations were urgently needed for the whole of the masonry of these clear stories." The conclusion was the same regarding the flying buttresses supporting the clear story walls, which in some places are dangerous and in others so decayed that pieces of stone are constantly falling from them upon the lead roofs. In regard to the south side of the nave, over the cloister roof, the report says:

"Large pieces of stone are continually falling, being detached by the rusting of the iron clamps with which the masonry was thoughtlessly put together. Very considerable damage has from this cause been done to the western towers, the whole surface of which is disfigured by the bursting off of triangular and other shaped pieces of stone; these heavy pieces fall not infrequently, and do much damage."

The transept on the south side has been recently restored, and the porch of the north transept is also new, but above the porch the masonry is in places very loose and unsafe, and demands complete and extensive repairs. The stone of the clear story of Henry VII.'s chapel, of the flying buttresses, and of the pinnacles is also badly decayed.

It is estimated that the cost of the restorations will be from £60,000 to £80,000, and the *Times* asks the pertinent question: "By what means may future generations be spared the periodical scandal of discovering that this great historical church has fallen into decay?" Judging from the rapid rate at which disintegration is now going on upon some of the buildings in this city, it will be but a few years before the above question may be applied to many of our finest edifices.

### To Prevent Railroad Accidents.

Railroad spikes pull out of ties by the spring of the rails under the weight and pressure of engines and trains. The spreading of rails, for this reason, is one of the principal causes of railroad accidents. General Manager F. K. Hain is putting in "interlocking bolts" on the curves, switches, and frogs of the elevated roads, where the greatest danger is encountered, as a protection against accidents. These are the device of Capt. Thomes J. Bush, of Lexington, Ky., and are without heads. They are put in from the upper side of the tie. Holes are bored vertically on either side of the rail in the places where the spikes would go. They cross under the rail, forming the letter X. The bolts have threads turned on the upper ends, which are bent so as to cause the nuts, when the bolts are inserted at angles, to come squarely down on the flange of the rail. A slot is cut in the side of one bolt, which is inserted first. The side of the other bolt is beveled up to a point where a notch is cut on the under side to come squarely against the shoulder and in the slot of the first bolt, and in that way the two lock. The nuts are then screwed down, and the rail is held as if in a vise. The pressure against the side of the rail, tending to turn it over, is resisted by the lower part of the X-like adjustment of the bolts, and nothing but the tearing out of the solid wood will release the rail. The device is expected to greatly deaden the sound, and in case a rail should break it would still be held in place. A number of roads are experimenting with the bolts, among them the New York Central, the Pennsylvania, the Erie, the West Shore, and the New York City and Northern, and Elevated Railroad.

### Glue, Paste, or Mucilage.

Lehner publishes the following formula for making a liquid paste or glue from starch and acid. Place 5 pounds of potato starch in 6 pounds (3 quarts) of water, and add one-quarter pound of pure nitric acid. Keep it in a warm place, stirring frequently for 48 hours. Then boil the mixture until it forms a thick and translucent substance. Dilute with water, if necessary, and filter through a thick cloth.

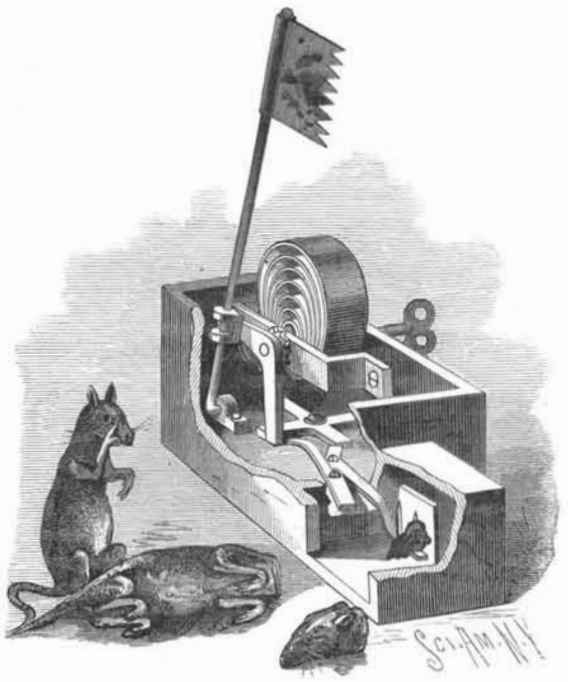
At the same time another paste is made from sugar and gum arabic. Dissolve 5 pounds gum arabic and 1 pound sugar in 5 pounds of water, and add 1 ounce of nitric acid and heat to boiling. Then mix the above with the starch paste. The resultant paste is liquid, does not mould, and dries on paper with a gloss.

It is useful for labels, wrappers, and fine bookbinder's use.

Dry pocket glue is made from 12 parts of glue and 5 parts of sugar. The glue is boiled until entirely dissolved, the sugar dissolved in the hot glue, and the mass evaporated until it hardens on cooling. The hard substance dissolves rapidly in lukewarm water, and is an excellent glue for use on paper.—*P. Notiz.*

### ANIMAL TRAP.

A powerful coiled spring surrounds a shaft, on one end of which is mounted a ratchet wheel with which a pawl, pivoted on a loosely mounted elbow lever, engages. The bent end of a rod is journaled in bearings secured to the base-plate in such a manner that the rod can swing in a vertical plane parallel with that of the spring. Upon the free end of the rod is a serrated knife. The rod passes loosely through the jaws of a U-shaped piece pivoted to the end of one arm of



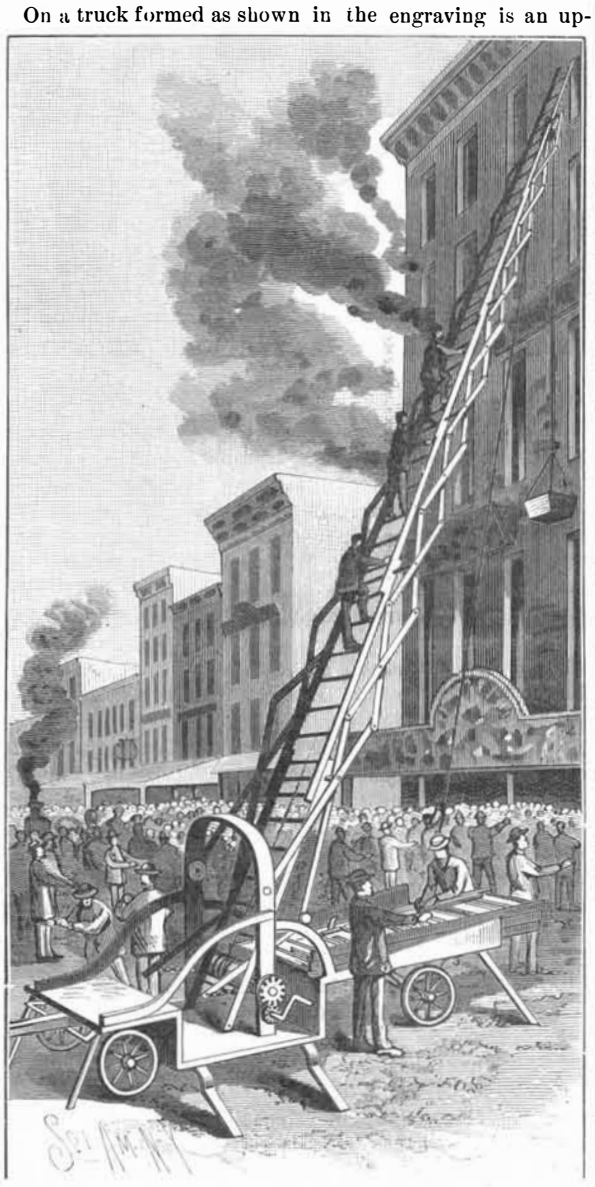
HALL'S ANIMAL TRAP.

the elbow lever. The other end of the lever rests against one arm of a cross-shaped piece centrally pivoted to the base. A bent lever is pivoted to the base in such a manner that the arms of the cross can rest against the bent section. On the other end of the lever are a plate and two prongs for holding the bait—this end of the lever being in a separate compartment of the trap. Pressing against the side of this lever is a second one. A mouse nibbling at the bait would pull the lever forward, thereby freeing the cross-shaped piece and allowing the shaft to make a complete revolution, during which the knife would descend, decapitate the animal, and ascend to its normal position. The mechanism will continue this operation until the spring has been uncoiled.

This invention has been patented by Mr. Charles Hall, of Changewater, N. J., and further information may be obtained from Messrs. J. Hill, Jr., and V. Castner, of same place.

### FIRE ESCAPE.

On a truck formed as shown in the engraving is an up-



LETTON'S FIRE ESCAPE.

right frame to which is connected, at each side near the end, a lazy tongs extension frame—one of the bars of a joint being pivoted to the frame. The other bar of the joint has a bar connected to it, which extends downward over the drum of a windlass, to which it is connected by a chain or rope. At the junction of these two bars is a friction roller that rolls along the side brace for support. The two extension frames are connected together by rods forming the pivots of each joint; to each alternate rod is connected the upper end of a short ladder, the lower end of the lowest ladder resting on the drum, and the lower ends of the others resting on the next ladder below. When a hand crank shaft, with which the drum is geared, is turned so as to wind the chains upon the drum, the extension frames will be projected upward; by unwinding the chains the frames and ladders will be lowered and folded down on the truck.

The bars pivoted to the upright frame are placed between disks provided with stops, to arrest the extension frames when elevated to the desired extent; when the windlass is strained up and made fast, the bars will be held firmly between the bearings thus formed, holding the frames rigidly in their working position. To the upper connecting rod of the frames is attached a pulley block and rope carrying a basket, which can be used for letting down persons or goods. Detachable braces stay the platform laterally, and pivoted bars swung down to the ground prevent the truck from rolling on the wheels. The device can be used from stationary platforms, awnings, etc.

This invention has been patented by Mr. T. P. Letton, and further particulars may be obtained by addressing Mr. F. M. Curtis, Ottawa, Kansas.

### The Cost of Running a Train.

As the passenger sits at a car window and sees the mile posts whirl past, he seldom stops to reflect what it has cost the company to pull the train a mile. A party of gentlemen, some of them experienced business men, sat in the lobby of the Kennard House yesterday, when the question as to the cost of running an ordinarily heavy passenger train was raised. Several of them made estimates, but every one of them was far below the amount. The average cost of running an ordinary passenger train of from six to ten coaches is from $1 to $1.25 a mile. This may seem large at first, but when the several items are taken into account one will suspect, after all, that the estimate is too small. One of the principal items is the running of the locomotive. It has been the study of master mechanics to reduce the cost of running an engine, and each claims to be a little closer in his calculations than the other. The average cost during January of running the engines on the Bee Line, for example, was 15·77 cents per mile. Freight engines run at a cost per mile of 17·73 cents. Passenger engines cost less, viz., 17·24 cents per mile; while switch engines, which are credited with so much mileage per day, regardless of the distances run, are run at so low a cost as to reduce the average to 15·77 cents per mile. The engines ran 34·63 miles to a ton of coal, and 16·38 miles to a pint of oil.

Added to the expense of motive power is the outlay for wear and tear of cars; it is estimated that it costs 3 cents a mile to keep a sleeping car running, and the wages of train hands, etc. The expense from the item of wear and tear is increased by an increase of the speed of a train. The special trains on the Lake Shore, running at a speed of about forty miles an hour, and the fast mail, at about thirty-seven miles, are the most expensive trains on that line. It is not generally known what the Government pays the Lake Shore people for running the fast mail from New York to Chicago, but it ought to receive at least $800 to fully compensate it. Another little item of railway operation is the expense of stopping and starting a train, which an experienced railroad man said yesterday could not be effected at a less expense than from 18 to 25 cents at each stop.—*Cleveland Herald.*

### Analyses of Dry Wood, and the Relation of Composition to Heat of Combustion.

Ernst Gottlieb has been investigating the elementary composition of wood dried at 115° C. (239° Fahr.), and the amount of heat that each is capable of yielding when burned. The carbon and hydrogen were determined directly by combustion, weighing the carbonic acid and water produced. The remainder, after deducting ash, represents the total oxygen and nitrogen. The actual quantity of the latter was determined only in a part of the samples.

| | Oak. | Ash. | Yoke elm. | Beech | Birch | Fir. | Pine. |
|---|---|---|---|---|---|---|---|
| Carbon | 50·16 | 49·18 | 48·99 | 49 06 | 48 88 | 50·36 | 50 31 |
| Hydrogen | 6·02 | 6·27 | 6·20 | 6·11 | 6·06 | 6·92 | 6·20 |
| Oxygen | 43·45 | 43·98 | 44 31 | 44·17 | 44·67 | 43·39 | 43 08 |
| Nitrogen | | | | 0·09 | 0 10 | 0·05 | 0·04 |
| Ash | 0·37 | 0·57 | 0 50 | 0·57 | 0 29 | 0 28 | 0 37 |

(It will be noticed that in no case is there sufficient oxygen to combine with all the hydrogen, hence a portion of the latter must exist in the form of a hydrocarbon.)

For the determination of the heat of combustion, the author constructed a particular form of calorimeter, described in *Journal fur Prak. Chemie*, in which the wood was burned in pure oxygen gas. The operation required but three minutes.

The results were higher than those calculated by Dulong's formula for the same composition. Wood containing 49·03 per cent of carbon, 6·06 of hydrogen, gave out 4,785 calorifics, whereas the amount calculated would be 4,139, if carbon gives 8,080, and hydrogen 34,180 units of heat.

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### ENGINEERING INVENTIONS.

A combined feed pump and condensing apparatus for engines has been patented by Mr. John Houpt, of Springtown, Penn. This invention relates to features of two former patents issued to the same patentee, and the combined apparatus covers a primary condenser, by which the exhaust steam is cooled to a temperature a little below that of boiling water, under a partial vacuum, a secondary condenser, operating to produce a good vacuum in front of the piston, and to keep a higher temperature in the cylinder than in ordinary condensing engines.

### MECHANICAL INVENTIONS.

A slide rest, for use on turning lathes, to guide the tool in forming the work, has been patented by Mr. Jacob Fitz, of Hanover, Pa. The invention consists in a sliding block and a guiding form interposed between the usual longitudinally sliding carriage and the tool rest carried thereby.

An automatic felt guide for paper machines has been patented by Mr. Benjamin A. Schubiger, of Montoursville, Pa. The guide roll and cone guides are mounted on a supporting bar with a center pivot, and there are carrying rolls on the opposite ends of the bar for supporting the ends, so that the felts may be automatically corrected when tending to run sidewise or out of line, from the tension of the web varying by the stretching of some parts more than others.

### MISCELLANEOUS INVENTIONS.

A flower pot has been patented by Mr. Daniel O. Martin, of Marshall, Ill. It is so constructed that a quantity of water will be retained in the lower part of the pot and at the same time air will have access to and can circulate around the roots of the plant, thereby promoting rapid growth.

A wire crimper has been patented by Mr. Matthew M. Jones, of Kokomo, Ind. A box with its front end closed and perforated for the free passage of wire has a transverse bar in combination with a hinged or pivoted lever handle, combined with other devices, for crimping wire in constructing picket and other fences.

Improved barbed metallic fencing forms the subject of a patent issued to Mr. Albert Potts, of Philadelphia, Pa. The metallic fencing strip, notched upon its edges, is combined with pointed wire staples, the staples being fixed in place in the notches by twisting their pointed ends together so barbs are formed upon the strips.

A sample trunk or case has been patented by Mr. Henry W. Mattoni, of New York city. It is made with stop springs interposed between the ends and sides and the ends and sides of its trays, so the latter will be kept in place and protected against sudden jars, arched metal springs and re-enforcing rubber springs being used.

A pump has been patented by Mr. Orlin W. Hammond, of Belmont, N. Y. It is an improved lift and force pump for adaptation to small bored wells, and has an air chamber attachment to the rod for working the piston, the rod being hollow and forming the water conductor for the delivery of the water from the pump.

A coal dumper has been patented by Mr. Thomas Wallwork, of Litchfield, Ill. The invention consists in the combination, with a frame, of a box hinged therein at one end, the frame being provided at one end with gates hinged to the top and bottom, the gates so connected that they open and close together automatically.

A caster wheel and die for making it have been patented by Mr. Walter S. Ravenscroft, of Parkersburg, W. Va. The caster wheel is made of woody fiber or wood or paper pulp, and has its central portion additionally compressed, for which purpose the dies have plungers operated by eccentrics, so rotated as to give any desired pressure.

A washer for vehicle wheels has been patented by Mr. Bartholomew Masterson, of Milford, Mass. The washer is jointed or hinged, so it can be secured on a spoke very easily and rapidly, without the felly being removed, it being passed around the spoke above the shoulder, where it will prevent any longitudinal movement of the spoke.

A door check has been patented by Mr. Frank M. Sears, of East Saginaw, Mich. Combined with a stud projecting from the door is a block with a transverse and a vertical aperture, a pin or bolt being held in the latter, and resting on a spring adjustable by a screw, making a convenient device for holding a door open, and preventing it from being opened too far.

An improved sleeve for coats and other like garments has been patented by Mr. Charles F. Butterworth, of Troy, N. Y. The object is to make an elastic, warm fit about the wrist, for which purpose is provided a hollow annular fur band, and a spring within it, and a securing strip, with one edge secured to the wristlet and its other edge interposed between the turned in portion of the sleeve and its lining.

A ball trap, for throwing targets, has been patented by Mr. Charles F. Stock, of Peoria, Ill. This invention relates to certain improvements formerly patented by the same inventor, and covers an improved clamp for holding the target, while a rear weight with a lip or projection is substituted for the rear extension of the arm and stud for suddenly stopping the swing of the arm.

A baling press has been patented by Mr. Andrew Johnson, of Greensborough, Ala. It has slotted ends, with ratchet bars at the sides of the slots, and fulcrum bars suspended near the ends, the press box being provided with a follower strengthened by a truss, and carrying spring-held catch bars to engage with the ratchet bars, with other details of special device, to facilitate the baling of cotton, hay, etc.

An improved sewing machine has been patented by Mr. George A. Annett, of Sutherlands Corners, Ontario, Canada. The invention relates especially to the needle and take-up mechanism, which is so combined as to accomplish by one movement the work of two essential parts, and they are so arranged that the thread will be slackened as the eye of the needle enters the goods, whether they be thick or thin.

A folding box has been patented by Mr. Henry Krog, Sr., of Washington, Mo. In combination with the bottom section and cover are removable sides and ends, a chain, screw bolt, and nut for pressing the bottom and cover against the bottom and top, edges of the sides and ends, and a fastening device in the end pieces of the bottom section, for holding the lower end of the chain.

A traveling brick machine has been patented by Mr. Henry Stelzmann, of Leech Lake, Minn. A locomotive machine is contrived to feed the clay from a tank it carries into a device for working preparatory to pressing, when it is passed through a press, and delivered in properly formed brick upon the surface of the drying yard, all by the automatic action of the machinery geared with the propelling engine, the only hand labor being that of substituting full for empty clay tanks.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*


Wanted—To sell State or county rights for the Folding Adjustable Climax Ironing Stand or Table. Patented Feb. 27, 1883, and Jan. 8, 1884. Patented in Canada Feb. 28, 1884. Canada patent for sale cheap; best selling article out. Send for circular. N. Scholl, Lock Box 1204, Chillicothe, Ohio.

The best Piston Rod Packing for steam or water is the Selden patent "Rubber Core" Packing, manufactured in all sizes by Randolph Brandt, 38 Cortlandt Street, New York.

Munson's Improved Portable Mills, Utica, N. Y.

Roller Velocipede. Circular free. O. T. Gleason, Temple, Me.

In the pipe Blackwell's Durham Long Cut Tobacco is even more luxurious than in the cigarette, for then it is a fuller smoke, its flavors are longer drawn, and its fragrances play around you like odors in a garden of lilies.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

Nickel Emery. We are selling pure Nickel and Emery at largely reduced rates. Greene, Tweed & Co., New York.

All Books on Electricity, cheap. School Electricity, N.Y.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, Lexington, Ky.

Sewing machine, water closet, & other light castings made to order. Lehigh Stove & Mfg. Co., Lehighton, Pa.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

Stationary, Marine, Portable, and Locomotive Boilers a specialty. Lake Erie Boiler Works, Buffalo, N. Y.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

The Hyatt filters and methods guaranteed to render all kinds of turbid water pure and sparkling, at economical cost. The Newark Filtering Co., Newark, N. J.

If you want the best cushioned Helve Hammer in the world, send to Bradley & Company, Syracuse, N. Y.

Iron and Steel Drop Forgings of every description. R. A. Belden & Co., Danbury, Ct.

"The Sweetland Chuck." See ad. p. 252.

Hoisting Engines for Mines, Quarries, Bridge Builders, Railroad Construction, etc. Send for catalogue. Copeland & Bacon, New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Pumps—Hand & Power, Boiler Pumps. The Goulds Mfg. Co., Seneca Falls, N. Y., & 15 Park Place, New York.

For Freight and Passenger Elevators send to L. S. Graves & Son, Rochester, N. Y.

Best Squaring Shears, Tinners', and Canners' Tools at Niagara Stamping and Tool Company, Buffalo, N. Y.

Lathes 14 in. swing, with and without back gears and screw. J. Birkenhead, Mansfield, Mass.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent Agency, 261 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Cotton Belting, three, four, five, and six ply, for driving belts. Greene, Tweed & Co., New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Curtis Pressure Regulator and Steam Trap. See p. 222.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 222.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 221.

Ajax Metal Company, Phila. Clamer's Ajax Metals for railroad, rolling mill, engine bearings, cocks, and valves.

Job lots in Rubber Belting, Packing, Tubing, and Hose. 75 per cent off belting. John W. Buckley, 156 South Street, New York.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's 1884 Book of Saws. New matter. 75,000. Free. Address Emerson, Smith & Co., Beaver Falls, Pa.

Hoisting Engines. Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 238.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 237.

Hand and Power Bolt Cutters, Screw Plates, Taps in great variety. The Pratt & Whitney Co., Hartford, Ct.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The Porter-Allen High Speed Steam Engine. Southwark Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Stephens Bench Vises are the best in use. See ad., p. 237.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Gears.—Grant, 4 Alden St., Boston.—Water motors.


### NEW BOOKS AND PUBLICATIONS.

THROUGH SPAIN ON DONKEY BACK. Drawings by W. Parker Bodfish. Boston: D. Lothrop & Co., Publishers. Quarto, unique binding, $1.50.

This is an entirely unique volume. Its illustrations are novel and numerous, and its letter press remarkably sprightly. To see any country "on donkey back" is to meet with surprising adventures, and see much more than the ordinary traveler sees. It introduces us to the homes of the people. It takes us into out-of-the way places and among out-of-the-way people. We learn their ways and amusements, their weakness and strength; we meet noblemen and peasants, priests and beggars, soldiers and citizens, women and children, people of fashion and husbandmen, dancers and singers, watersellers and herdsmen, shoemakers and fruiterers.

BERLY'S UNIVERSAL ELECTRICAL DIRECTORY. A reference book for industries connected with Electricity and Magnetism. Wm. Dawson & Sons, London: Cumming & Brinkerhoff, New York.

This book is a comprehensive directory for the use of all engaged, experimentally or practically, in any of the numerous applications of electricity to the arts and sciences. With much valuable information as to the present state of our knowledge in this department, it gives classified lists of manufacturers and dealers in articles required for every use to which electricity has thus far been put, in America, in Great Britain, and on the Continent of Europe. The mere enumeration of the articles now called for in this line would make an extended catalogue. The kinds of wire alone afford an immense variety of brass, copper, iron, galvanized iron, German silver, phosphor-bronze, steel, insulated in various ways, or with different coverings; then there are all kinds of telegraph and telephone materials, electric light and dynamo machine appliances, chemicals for use in batteries, etc., and this book gives the buyer the means of reaching first hands through all this field. It also gives the officers and 1,111 members of the London Society of Telegraph Engineers and Electricians, with statistics about the telegraph, telephone, cable, and electric light companies of the world.

FOUNDATIONS AND FOUNDATION WALLS By George T. Powell. William T. Comstock, New York. Price $2.00.

This is a revised and enlarged edition of a book which has already met with a large degree of public approval. It treats particularly of pile driving, building stones, and bricks, as well as of mortars, limes, cements, and concretes, gives tables of weight of materials, and practical explanations of the various methods of building foundation walls for all kinds of buildings.

## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) M. D. D. asks: Is there any difference in the manufacturing of silver steel and ordinary cast steel? Are circular and cross cut saws made of silver steel better than those made of the ordinary cast steel? A. Alloys of steel with less than one five-hundredth of silver have been made in England for fine cutting instruments, but not known to have come into trade use. Cutlery has been imported from England, and probably made here, under the name of silver steel. The silver part had more relation to the high luster of its finish than to its composition. There are quite a number of grades of cast steel suitable for the various kinds of tool making. Saws are not made of the highest grade, as they require to be tough and elastic.

(2) W. M. asks: Can the bone of an ox be softened to such a degree by boiling with steam of high pressure that it may be crumbled by the thumb and finger like a boiled mealy potato? If so, please state how great the pressure must be, what the temperature must be, and how long must it be used. Please inform me of the best cement for cementing a patch on a rubber boot? A. By using superheated steam at a temperature at which the bones will not become charred or burnt, you can accomplish your purpose. See article on page 71 of SCIENTIFIC AMERICAN for Feb. 2, 1884, on "Two New Processes for Making Artificial Ivory." For cement see rubber cements, on p. 2510 of SCIENTIFIC AMERICAN SUPPLEMENT, No 158.

(3) J. S. writes: An expert in this city claims that a copper ball perfectly air tight, used as a float in hot water, will in time fill with water and sink, and still be air tight or not leak. Some of us can't see it; won't you give us light? A. Floats that are called air tight are not always tight, especially if there is any pressure upon them. Thus floats have been used in steam boilers, and are now occasionally used in France for low water detecters. They are not reliable. They may be absolutely tight when first put in, but do not stay so. The hot water and steam has a disintegrating effect upon the joints, and the pressure in time fills the float with water. If there is no pressure, as in a hot water tank, the heat of the water expands the air upon the inside of the float, producing pressure, which will let out the air through a leak that does not otherwise show. When the water is cold, there is a corresponding pressure inward which carries in a little water. Repetition of this process soon fills the ball.

(4) C. L. B. writes: 1. I wish a power for a small mill, and I would ask if it is advisable to run it by sand power? A. We do not think that sand storage power is as yet practicable. 2. Which is the best—the vertical or horizontal flouring mills? A. The horizontal mills are considered best. 3. Which is the best—an upper or under running stone (I mean portable mills)? A. The under running stone is considered the best. 4. Should cogged gearing be greased or run dry, such as a thrashing machine horse power? A. All quick running gearing runs better and lasts longer if greased.

(5) D. R. W. & Co. write: Can you furnish us with information for building oven for japanning iron castings? If there is any work in print treating on the subject, please let us know, and we will send price. A. We know of no practical work devoted to the subject of japanning. For japanning you will require from 240° to 260° temperature. The ovens are usually made of brick for safety, and heated by an iron flue or stove pipe passing around the room, the fire being upon the outside. Some place a heater (such as is used for dwellings or stores) in a chamber below the drying room, arranged to let the hot air pass up into the drying room. There should be no communication between the hot air chamber and the open fire that could possibly admit the vapor of the varnish to the fire. Steam is also used in coils of iron pipe laid around the room. It needs a pressure of from 60 to 80 pounds in the coils to make a useful temperature.

(6) L. F. writes: I have been trying to make butter color, according to the receipts you give in SUPPLEMENT, No. 316. After carefully following your direction I have been able to impart but a slight tinge to the olive oil I have been using. Can you suggest any improvement in the process, and thus help me out? A. We are unable to assist you in your difficulty. Both the annatto and turmeric are substances capable of imparting their color to oils and butter, when treated in the manner as described, and we fail to comprehend why they do not act in your hands. Perhaps, by using a larger quantity, the desired result will be accomplished, or it may be that the heat is not continued for a sufficient length of time.

(7) H. G. K. writes: I have bought two lenses, with which I wish to make a telescope. They are a double convex lens for object glass, about one and three-eighths inch diameter with focus of about 72 inches, and a plano concave lens for an eye piece about five-eighths inch diameter and 1·1 inch focus. 1. How far should I arrange the lenses from each other? A. Place the concave lens the distance of its own focus *within* the focal point of the convex or object lens. 2. What will be the magnifying power? A. The power will be the focal length of the object lens in inches divided by the focal length of the eye lens in inches, or 65 times. 3. Does not the concave eye piece make the object smaller, and as I have a double convex eye piece yet of about one inch focus, would it not be better to use that? A. You can use the double convex eye piece by placing it its own focal length beyond the focal point of the object glass. 4. What would be the magnifying power then? A. Power as above, or 72 times. 5. When it is said that a telescope magnifies 100 times, does it mean that it makes the object ten times higher and ten times wider? A The magnifying power means diameters, or 100 times wider and 100 times higher.

(8) C. S. H. writes: 1. We have a phrenological bust that has become much soiled from dust, etc.; the faculties are all labeled. How can I cleanse it? A Of stearine and Venetian soap, each two parts; pearlash, one part; the stearine and soap cut small and mixed with 30 parts of solution of caustic potash, boiled for half an hour, stirring continually. Add the pearlash dissolved in a little rain water and boil a few minutes; stir until cold and mix with more lye until it is quite liquid; keep well covered up. Remove all dust and stains from the plaster, and apply the wash as long as it is absorbed. 2. Some old putty has discolored my new nickel plated irons. How can I remove the color? A. Polish the nickel with a little rouge; first however apply alcohol or ether to remove the oil contained in the putty stain. 3. Can cider be kept in glass cans or jars, if put in when cider is new, and kept well sealed? A. If hermetically sealed, cider will keep. The addition of pepper seed and other spices is sometimes desirable.

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(9) A. L. writes: Can you tell me where I can find directions for making plaster casts, say of a head, arm, or foot, from the living subject? The trouble is with the moulds. A. We do not know of any work treating of plaster casts. It is not difficult. Use boiled linseed oil to keep the work from sticking together. So divide the subject that each section will draw off when set. This is the principal feature of the art. Ordinary putty, made soft by the addition of a little linseed oil and working, answers for a bed or stop when a half mould is to be started. For instance, a hand may be laid flat upon the soft putty and partially embedded, so as to be even with the parting lines; then raise a thin wall of the putty or a piece of tin around the hand to keep the plaster from spreading, then pour the freshly mixed plaster upon the hand. The plaster should be just thin enough to pour easily; a few trials will enable you to make the best mixture. In a few minutes it will set, when the hand can be lifted from the putty and the mould taken from the hand, trimmed and gauged or doweled by making a few countersunk holes on the flat part outside of the hand for steadying the opposite mould; then oil well the mould and the hand and lay the hand in the mould, upside down from its original position; put the piece of tin or a wall of putty around as before, and pour in the plaster; allow to set, then part the mould and let it dry. Then oil the inside, thoroughly put together, and tie with a string; it is then ready for the final cast, which we think will be clear to you. To cast a face or head is much more difficult. The hair requires to be laid smooth with a mixture of lard and tallow, so as not to stick to the plaster, a tube for the nostrils to facilitate breathing. A front face can sometimes be taken in a single cast. It will be safer to become familiar with other parts of the body, as the hands, feet, etc., before attempting a face. When you are ready to try a face, commence by sections, as a quarter side, chin, and mouth, and in this way learn to combine the parts.

(10) P. J. N. writes: I have a very old superior violin. In having it somewhat repaired, the ignorant repairer also, thinking, I suppose, to add to its appearance, gave it a coat of bright red dye, and then of varnish, not thereby injuring the tone, but completely spoiling its looks. I have removed the varnish and dye from it, and wish to recolor and varnish it again. Will you please inform me what dye I shall use (some dye commonly used for such purposes)? Also what varnish? A. We would recommend you, if the instrument is a valuable one, by all means to put it at once in the hands of some competent violin repairer. An excellent brown can be prepared by putting 2 ounces dragon's blood, bruised, into a quart of oil of turpentine; let the bottle stand in a warm place, and when dissolved steep the work in the mixture. If this be too dark colored, it can be diluted by using a larger amount of the oil of turpentine. The formula for a suitable varnish is given in answer to query 3, in our issue of March 8, 1884.

(11) A. McK. asks (1) how to lay thin veneers on lumber one-eighth inch thick. A. A good manner of laying veneers on thin work is by clamping with screw clamps or weights between two planks dressed flat, with paper each side of the veneered parts to prevent sticking. 2. A receipt for making a good liquid glue. A. Liquid glue—4 ounces hard glue, 16 ounces acetic acid; dissolve by soaking and heating. Spaulding's glue is supposed to be ordinary glue dissolved in good, strong vinegar. Another way is to add a little pyroligneous acid to a thick solution of glue and water.

(12) S. B. G. complains that ever since enlarging his well the water has tasted bad during the hot months, although previous to the change the water was pure all the year round. A. You have not given us the essential facts in regard to your well. You say that before you enlarged it the water was good during the hot months. Did you put a wooden curb in? If so, was it oak or pine? Does it taste of rotten wood, or of decayed animal matter, or fishy from minute insects or animalcules living in the water? Possibly the well is so large that there is both vegetable and animal growth in the water. Small animals sometimes are drowned in wells without being noticed, having lodged in the stone work. Frogs are known to taint wells where the upper part is loose. A trout in a well will often keep it clear of small water insects and larvæ.

(13) W. C. S. asks: 1. What metal or alloy must I use to secure the greatest and most rapid expansion and contraction when exposed to the flame of an alcohol lamp or gas jet, and afterward allowed to cool off? A. Zinc expands most, but does not return to its original dimensions. Brass is probably the best metal for your purpose. 2. The length of the piece to be used being about one inch, of what shape and thickness should it be to reach the desired end? It must be capable of standing the heat of the flame for a considerable length of time. It must not melt. A. A cylindrical tube would probably be best. 3. Where can I find the best information concerning the expansion and contraction of metals? A. Consult any work on physics.

(14) F. W. W. writes: 1. A common hard coal base burner in sitting room of dwelling house here, on being touched by the finger of a certain person, gives a spark one-eighth to one-quarter inch long. No unusual conditions surround either stove or person, but stove will not give spark to any other person, and person cannot get spark from any other stove or object, and only from this one when temperature is 20° or more below zero. A. This phenomenon is common in houses warmed by furnaces, and in other dry houses. The friction of the feet upon the carpet is sufficient to generate enough electricity to yield a spark which will light gas and give a perceptible shock. The persons who could not produce the spark had something about the clothing or person which dissipated electricity as fast as generated. 2. A freight engine, Denver & Rio Grande road: In cab an iron brace passes within a quarter of an inch of a screw head in wood of cab; brace touches boiler; screw touches nothing but wood. Passenger engine on same road: Brass message hook screwed in wood of cab, entirely insulated from any metal; hook has spring guard over it to keep messages on it; point of hook and guard a quarter of an inch apart; both touch no other metal. Now, in both engines a spark can be seen between brace and screw head and between hook point and guard, when steam is escaping rapidly from the popper or safety valve in dome, and at no other time. Temperature has no effect in this case. A. A form of electric generator has been devised which operates by a jet of steam. The locomotive in these cases was an electric generator of this class.

(15) F. E. C. asks: 1. Is one 1½ quart gravity battery sufficient to make a dining room bell ring? A. Yes, provided the bell is adapted to the current. 2. Is not a bisulphate of mercury battery, the negative substance being a carbon cell, one of the strongest one fluid batteries? A. Yes. 3. Could a small boat (say two feet long) be run by about three bisulphate of mercury batteries, which are about two inches in diameter and the same in depth? A. Not very successfully. Better use a bichromate battery. 4. Could I make a small dynamo (for giving shocks) cheap, and about how much wire would it take for coils? A. A small dynamo is not well suited to your purpose. Better make a magneto. There is no way of making a good machine cheaply. Wind enough No. 36 wire on your armature to give it a resistance of at least 200 ohms. 5. In making a gravity battery, which is the best—to have the zinc or copper plate the largest, or to have them the same. A. The copper plate should be fully as large as the zinc. 6. I have a number of carbons such as are burned in the arc lights; would they be any better (after the copper is filed off) for the negative plate than copper in any of the sulphate of copper batteries? A. No.

(16) E. E. R. writes: The following questions have been discussed here by several mechanics; no two agree; please give formulas. There are a number of us take your paper from our book store. 1. If you have an engine of 60 horse power with a cage speed of 600 feet per minute, what load will it lift from the bottom of a shaft, and what will it haul up an inclined plane with a gradient of 1 in 3? A. The weight lifted, 3,300 pounds, and on the incline 9,900 pounds, less friction of plane, but this assuming that the power is 60 horse power net; that is, delivered at the rope. This weight includes weight of rope and cage and appurtenances. There should be some deduction for friction of rope and cage. 2. If you have an engine 12x24 on first motion, with a drum of 10 feet diameter, 40 revolutions per minute, 70 pounds steam pressure, how much will it lift from the bottom of a shaft 250 feet deep? A. Assuming 55 pounds average net pressure on pistons=30 horse power net with conditions same as above, 792 pounds weight. 3. If you have an engine 12x24 second motion, geared with a 12 inch pinion to a 5 foot drum, how much will it lift from the bottom of a shaft 220 feet deep? Of course you can assume speed and steam. A. Assuming pressure on pistons and speed of engine same as No. 2, power=30 horse power with conditions same as No. 1, 7,717 pounds; but from this must be deducted the allowance for friction of 2 inch motion shaft and gearing.

(17) J. N. W. asks for a receipt for making "off color" diamonds appear perfectly colorless. There is a receipt. I think it is a mixture of Prussian blue and alcohol, but I do not know what quantity to use; can you tell me? A. Diamonds having a yellow hue are said to be rendered colorless by being dipped into a solution of the aniline violet well known as mauve, violet de Paris, methyl violet, etc. A thin coat remains on the stone, and as violet is the complementary color of yellow, the diamond appears perfectly white or slightly bluish, which renders it still more valuable.

(18) H. C.—The pump will work with hot slops if the packing and valves are *not* leather. If they are leather, make them of rubber or metal. If the pump makes an 18 inch stroke, and 10 strokes per minute, it will discharge 1,000 gallons per hour and will take a horse or mule power to work the pump.

(19) E. B. H. asks how to do japanning on malleable iron. A. Paint the work with the japan varnish and place in an oven heated to 250°. The oven must have *no* direct communication with the open fire, as the evaporation of the volatile spirit of the varnish mixed with the air makes an explosive compound. Use a furnace outside of the oven, with the pipe passing around the oven. Make the oven of brick or iron. If you have steam at 60 pounds pressure, you can make a steam coil on the bottom of the oven answer your purpose, which is far safer than a stove.

(20) S. O. H. asks: 1. Will a boiler 9 feet 6 inches long, 48 inches diameter, with 120 2-inch tubes, and with a good draught, furnish steam for a 17 horse power engine? A. Yes. 2. We now run a boiler 19 feet long, 48 inches diameter, two flues 16 inches diameter—which of the two boilers consumes the most fuel? A. We think the tubular boiler would prove most economical, provided you have good water. 3. We have a steam pump with steam cylinder 13x14 inches, water cylinder 8 inches, suction 5 inches, and it draws water 25 feet, discharge pipe 4 inches, with lift 170 feet high, 50 strokes per minute, 40 pounds steam pressure of piston. What horse power, does the pump exert? A. About 7⅛ horse power, depending somewhat on arrangement of pipes and the friction.

(21) M. R. S. asks: Can you explain to your readers the operation of the storm glass? The larger tube appears to be nearly filled with alcohol and camphor, leaving a small air space. The instrument certainly indicates, to some extent, approaching changes of weather. But how can it do this, when it is hermetically sealed? It is affected, somewhat, by heat and cold. A. No satisfactory explanation of this phenomena has ever been given, so far as we know. It has been suggested by certain English authorities that electricity was the means of effecting the changes in the solution.

(22) L. McN. asks for a receipt for making an infusible cement that will stand a great heat without crumbling or falling off, as I want to line a hot blast gas furnace with it. Also a receipt for making crucibles that will stand the intense heat of the hot blast gas furnace. I would like the cement to be non-conducting. A. A good fireproof cement is given in answer to query 58, on page 28 of the SCIENTIFIC AMERICAN of January 13, 1883. The black lead or graphite crucibles will be found most suitable for your wants. The composition of these is 52·6 per cent of carbon, 45·4 of earthy matter, and 2·08 of water. The earthy matter used is fire clay.

(23) F. A. L. asks for a receipt for a good, lasting, cheap perfume. I have tried several cologne receipts, and find all too expensive. The following is quite cheap, and will, we think, meet with your approbation: Mix 1½ fluid ounces oil of lavender, ½ fluid ounce oil of rosemary, 1 fluid ounce oil of lemon, and 20 drops oil of cinnamon with 1 gallon alcohol.

(24) J. M. R.—The following are both French polishes: 1. Shellac, 3 pounds; wood naphtha, 3 pints; dissolve. 2. Shellac, 2 pounds; powdered mastic and sandarac, of each 1 ounce. Copal varnish, ½ pint; spirits of wine, 1 gallon; digest in the cold till dissolved.

(25) J. D. asks how to make a good chocolate brown on sumac leather. A. Try the following: Boil equal parts of pine and alder barks in six times their bulk of water until all the coloring matter is extracted, and when cold add a small quantity of alcohol. Saffron boiled for 12 to 15 hours makes a good brown stain, to which alcohol must be added to make it set.

(26) W. H. C. asks (1) how to obtain a bright, glossy polish on a black walnut counter. A. A good black walnut polish is prepared by taking pulverized asphaltum, and put it in a jar or bottle, pour over it about twice its bulk of turpentine or benzol, put in a warm place, and shake occasionally; when dissolved, strain and apply it to the wood with a cloth or stiff brush; should it prove too dark, dilute with turpentine or benzol. If desired to bring out the grain more, apply a mixture of boiled oil and turpentine. When the oil is dry, polish the wood with a mixture of 2 parts shellac varnish, boiled oil 1 part; shake well before using. Apply with a cloth, and rub briskly. 2. Also a bright, glossy polish for a Georgia pine floor. A. For the pine, use white bleached shellac, 3 ounces; white gum benzoin, 1 ounce; gum sandarac, ½ ounce; spirits of wine or naphtha, 1 pint; dissolve. 3. Also a cheap amber color paint to paint the ceiling, which will readily wash off. A. For amber color paint: Mix French yellow in boiled oil, adding sufficient red lead or litharge to produce the desired shade.

(27) H. D. H. writes: We desire to know how to make "liquid gold" for use in china decorating. A. Powdered gold, which is prepared by grinding gold leaf with white honey on a porphyry slab until reduced to the finest possible state of division; this is mixed with thick gum arabic and powdered borax. With this mixture the design is traced on china, etc., and baked in a hot oven. The gum is then burnt and the borax vitrified, and at the same time the gold is fixed on the china.

(28) J. W. L. asks what material white clay pipes are made of. A. The clay pipes are mostly imported, and are largely made in England. It is probable that suitable clay for this purpose is found among the clay beds of New Jersey, but this is used chiefly in the potteries. Pipe clay is of about the same quality as that used for the manufacture of pottery. To burn white, the clay should be free from iron.

(29) G. H. L. asks for a receipt for dyeing the lining of carriages, etc., without removing it from the carriage. Something that could be applied with a brush or sponge. A. Apply an aqueous alkaline solution of aniline blue while hot, with a brush, and then go over the work, using another brush, with dilute oxalic acid.

(30) W. McK.—The width of the English Channel between Calais and Dover is 21 miles.

(31) S. B. H. asks for a receipt for making precipitated chalk, also for stove polish? A. Take 5 parts calcium chloride, 13 parts sodium carbonate, with a sufficient quantity of distilled water. Dissolve the calcium chloride and the sodium carbonate each in 2 pints (Imperial measure) of the water. Mix the two solutions, and allow the precipitate to subside. Collect this in a calico filter, wash it with boiling water until the washing ceases to give a precipitate with silver nitrate, and then dry the product at a temperature of 212°. We give a formula for a paste stove polish as answer to query 7 in the SCIENTIFIC AMERICAN for June 9, 1883.

(32) M. W. F.—The ball is moving at its greatest velocity at the moment of leaving the gun, and its power of penetration is greatest at that point. The friction of the air gradually retards its motion during its flight. No projectile moves in a straight line, but curves toward the earth.

(33) T. S. V.—A receipt for making an oil paste shoe blacking is as follows: Ivory black in impalpable powder, 1 ounce; molasses, ⅛ ounce; sperm oil, ⅛ ounce; sulphuric acid, ¼ ounce; hydrochloric acid, ⅛ ounce; mix the first three ingredients, then add the acid with enough water to reduce to proper consistence. Triturate together until a perfectly homogeneous paste is obtained.

(34) A. J. L. writes: Suppose a two inch (diameter) pulley on shaft is driven six hundred turns per minute by a one and a half inch belt, moderately tight, and the shaft is doing as much work as it can without slipping the belt. How much power is consumed in driving the belt, that is, about how much power is the machine using from a line shaft or other appliance for driving it? A. Nearly one horse power, estimating the lap upon the pulley at 0·4.

(35) O. V. D. writes: I have had a great deal of trouble in hardening small steel pinions, etc.; would be obliged for your advice. How can I harden small articles of polished steel without discoloring or scaling them? A. You do not tell us what your troubles are. To keep the pinions bright, cover them with a little hard soap. Heat in an alcohol flame to a full red, and harden in water or oil. If the alcohol lamp does not heat to the proper degree use a blowpipe, open flame. Some prefer to lay the pinion upon a piece of charcoal in a little groove to keep it from rolling; heat with the blow pipe with alcohol flame, and quickly throw into water. If the pinion is long and slender, it may be liable to spring by throwing into the water. A piece of slender binding wire attached will enable you to plunge it endwise. Experts can do this by making the groove near the end of a piece of charcoal, and tipping the charcoal so as to let the pinion slide into the water endwise.

(36) G. T. E. asks: How can I make brass castings smooth, and without blow holes, and what kind of material should I use to make my mould? A. To make brass castings smooth, mould in very fine sand that has a little clay in it, such as the fine loam or yellow top soil from the prairies. Or better, obtain some fine moulding sand from a foundry, where they have experience in selecting the right kind. Face the mould by dusting finely pulverized charcoal or flour upon the face of the work. Use the sand as dry as will mould without breaking up. If too wet, it will blow the castings.

(37) C. C. M. Works ask: Where is the most successful steam heating company in the United States? A. The New York Steam Heating Company is supposed to be the most successful, as they have supplied steam very steadily over a large district for about three years. There is one in St. Paul, Minn., that claims to have been successful, but we have not heard from them during the past year. There is also one at Belleville, Ill. The Troy, N. Y., Co., have failed, as also the American Co. of New York.

(38) A. S. G. asks in what respect the tremendous wheel illustrated in No. 10 of SCIENTIFIC AMERICAN, used by the Calumet and Hecla Mining Company is superior to an elevator such as is used in a flour mill? A. The elevator bucket system as used in mills, when enlarged to the capacity of the great wheel of the Calumet and Hecla Mining Company, would weigh, with its elevated frame work and guides, more than the great wheel, and would have a great number of loose or working joints carrying successively great strains, which would cause rapid wear and breakage. The friction of this class of machinery is much more than the simple bearings of a single wheel.

(39) J. W. H. Jr., asks the horse power of the following two engines, each having 60 pounds steam pressure: No. 1. 2½x4 inch cylinder, ports ¼x1, exhaust ½x1, ½ inch steam pipe, 300 revolutions per minute, well built, horizontal, and all works easily, rock shaft for steam chest valve. No. 2. Same style as No. 1, but 3x5 cylinder, ¾ inch ports, ¾ exhaust, 60 pounds pressure, 250 revolutions per minute, ¾ supply pipe. You will tell me where I can find rules for calculating the power of engines, the above data being known. A. No. 1. 1¾ horsepower. No. 2. 2⅝ horse power. For rules for finding horse power of engine, see SUPPLEMENT, No. 253.

(40) W. L. S. asks: 1. Where can I get a copy of the U.S. statutes in regard to the inspection of river steamers, licensing of masters and engineers for the same, etc.? A. Apply to the Steamboat Inspectors, or write to the Treasury Department, Washington. 2. Is it good practice to use a spring, such as a pair of spring scales, on the lever of a safety valve? A. No; not except specially fitted for the work.

(41) R. O. F. writes: We have a question in dispute. We lately read an article about a rat that had got into the machinery which generates the electric light for a large Chicago firm, and by placing his forefeet on one of the dynamos and his hind feet on the other caused the current to pass through his body, killing him instantly and at same time forming a short circuit which immediately extinguished the lights; it also stated that they could get no light until the rat was removed. Now, we desire to know if this is a fact? A. We doubt some parts of the rat story. The current might kill a rat, and the rat might possibly forma connection between two wires sufficient to start an arc and thus stop the lights on the circuit, but the rat would be rapidly cremated.

(42) O. W. asks the receipt for making cement pavement. A. Cement pavements may be made with Portland cement, broken stone, and sand. If for foot walks, 3 inches in depth of small broken stone may be rammed evenly upon the earth bottom. Mix Portland cement and water to the consistence of cream and pour over the surface, spreading with a stiff broom. When hard, spread with fine gravel mixed with cement and water 1½ to 2 inches deep. Then a coat 1 inch deep of sharp clean sand (such as is used for making mortar), mixed with equal parts of Portland cement, with enough water to make the mass like mortar. Lay evenly and smooth. This will set strong enough to walk upon in from 1 to 2 days. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 33.

(43) G. H. W. asks: 1. Will the dynamo machine described in SUPPLEMENT No. 161, run one of Edison's incandescent lamps (8 candle power)? A. No. It will run three 3 candle lamps, however. 2. If it will not, is the machine powerful enough to store, during the day and night, sufficient electricity to maintain three or four of the above lamps during the evening? A. It is rather small for the purpose, but it might do it. 3. Should the armature of the dynamo machine be wound with coarser or finer wire than No. 18, to give the best results with the storage battery? A. Coarser. Try 16.

(44) W. F. S. asks for the composition of the wax used for engraving relief line maps. Or refer me to a work on wax engraving. As I understand it, the wax is spread on copper plates. The engraving is made, the wax and the electrotypes made direct; but I do not know the kind of wax used. A. Paraffine is used. If required of dark color, melt and thoroughly mix a little fine lamp black, or, what is better, the bone black from the artist furnishing stores. Some use asphalt and beeswax. Asphalt will also mix with the paraffine and make a very tough wax.

(45) P. H. W. asks: Suppose a rifle ball be shot directly downward to a target 50 feet below, leaving the muzzle at a velocity of 1,200 feet per second, and another ball sent vertically upward (starting with the same velocity). Will the force of gravity cause the first to reach its target in any less time than the other, the distance being the same? If so, why do we give to the gun sight less elevation when shooting at an angle downward than when shooting at an elevated target? No practical sportsman, standing on the bank of a river 30 feet high, would elevate his sight to shoot at game on the water at one hundred yards distance. A. The ascending bullet would be retarded by gravitation, while the descending one would be accelerated by gravity, and would reach its target first. Be-

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cause, when firing downward the bullet is accelerated by gravity, and the trajectory will be a smaller curve than in horizontal firing, requiring the breech sight to be low. When firing upward, the bullet is retarded by gravity, making the trajectory a greater curve than in horizontal firing, requiring the breech sight to be high. In shooting at game on the water, however, it is necessary to aim under the bird, as there is an optical illusion.

(46) W. A. G. asks: Are there any coal gas machines that are small enough for one or two families, and what price? We have here good coal for $1.75 per ton. A. We have not heard of any coal gas works or machines for a few lights. Naphtha and oil gas machines are made of suitable sizes for factories and hotels. Air gas machines, made by vaporizing gasoline and mixing the vapor with air, are numerous in this market, and of suitable size for small establishments.

(47) C. C. H.—For a durable drive way, a bed of asphalt and coarse sand two or three inches thick, laid upon a well rammed bed of broken stone three or four inches thick, is the best. A concrete bed of Portland cement and gravel laid upon broken stone is also good. The tar from a gas house, mixed with sand and laid upon broken stone well rammed and covered with a thin coat of loose sand and rolled, and given a few days to dry and harden, makes a very cheap drive way.

(48) C. E. De P. asks: 1. Where can I obtain the monoxide of copper, or how can I prepare it? I tried to do it by precipitating a solution of sulphate of copper with a solution of potash, but the precipitate instead of being black powder is a green insoluble substance. What is the trouble? What is the cheapest way to get it? A. Copper monoxide is prepared by calcining metallic copper at a red heat with full exposure to air, or, more conveniently, by heating the nitrate to redness, which then suffers complete decomposition. 2. What is the process of coloring kid gloves? What is the coloring material that is used? A. The gloves are generally stuffed with cotton, and the coloring matter applied by means of a sponge or cloth. 3. How can the gloss be best removed from photographs before coloring? A. To accomplish this, rub the picture with a little finely pulverized pumice stone, applying it by means of a buff badger.

(49) B. W. asks: Will a 4 inch pipe draw any more water out of a reservoir running down a hill 400 feet, than it will running down 33⅓ feet, each having same head over mouth of pipe? A. We understand you to mean the head above the point of delivery; if this is correct, your 400 feet of pipe would deliver slightly less than pipe 33⅓ feet.

(50) S. P. B. writes: In No. 6, SCIENTIFIC AMERICAN, vol. xxxii., of 1877, your paper gives a notice of the building at that time of a "two foot cheap railway," between Billerica and Bedford, N. H. Did this road prove a success? What is its capacity in freight? A. This road, proving unsuccessful, was abandoned.

(51) C. B. U. asks: 1. Can the string of a piano be made to vibrate hard enough to endanger its strength by *continually* striking its key note on some other instrument near by. Again, can a bridge (suspension) be made to vibrate by striking its key note on a musical instrument near it, so as to endanger its strength? A. The induced vibration of the string of the piano would, we presume, in time be sufficient to endanger its strength, although it will be less in volume than that from the strings of the initial instrument. Theoretically, yes.

(52) A. D. H. asks how to remove pimples from the face. A. The removal of pimples depends largely upon a correct diagnosis of their condition and a knowledge of their cause. Therefore, we would recommend consultation with a competent physician in regard to your difficulty. A receipt for the removal of comedones is given on page 52 of the SCIENTIFIC AMERICAN, for January 28, 1882.

(53) R. B. asks: 1. If the pressure per square inch of a boiler is 90 pounds, will the pressure in the water glass be 90 pounds per square inch also? A. The water gauge glass should and does have the same pressure as the boiler per square inch. If not, something is wrong. 2. Does an engine of 10 horse power with 9 in. stroke take more steam than a 10 horse power engine with 12 in. stroke? A. A 10 horse engine should take the same quantity of steam at 9 in. or 12 in. stroke. The diameter of the cylinder should vary inversely as the stroke for the same power. 3. Will a box of an engine that knocks because it is too loose become heated? A. A knocking box will be more liable to heat than a properly fitted box, the knocking having a tendency to throw out the oil and make the box dry. 4. Will a large shaft heat quicker than a small one, running at the same speed? A. If you take simply the weight of the two shafts into consideration, the large shaft will heat more quickly than the small shaft at same speed, because it has a greater weight, and contact surface rubs at greater speed. If, however, the shafts sustain considerable weight, so that the difference in the weight of shafts themselves becomes an unimportant factor in the problem, then the conditions are changed, and the smaller shaft will heat more rapidly than the larger, owing to the greater weight per square inch of bearing surface upon the former.

(54) A. W. asks if a Plante storage battery consisting of 40 pounds of sheet lead, having 7,000 square inches of surface, is capable of running one incandescent lamp for one hour? A. The battery referred to would run a small electric lamp for an hour. It would not, however, run one of the ordinary high resistance lamps.

(55) R. M. asks: 1. Whether "rotten wood ashes, principally from beach and sycamore," are valuable as fertilizer on red clay land, in which there is a mixture of gravel? A. Wood ashes are always valuable as fertilizers. 2. Would the refuse of a lime kiln having been exposed to the weather for a long time have value as a fertilizer? A. The lime kiln refuse is good in itself, and better mixed with muck. 3. My wife fails of success in using the bread recipe of "S. H.," in the SCIENTIFIC AMERICAN of Feb. 2, 1884. Is anything left out in the published recipe? A. The recipe of S. H. is the old-fashioned "salt rising," where yeast is not at hand. It is the production of yeast and bread sponge at the same time. If the conditions are observed and the flour is good, there need be no failure.

(56) S. R. writes: 1. What is meant by the pitch of a toothed wheel? A. The pitch line of a wheel is the circle upon which the pitch is measured. The pitch is the distance between the centers of the teeth upon the pitch line. 2. And the simplest way to take the pitch of any wheel? A. In properly constructed teeth the pitch line should be seven-tenths of the distance from the bottom to the top of the teeth. Thus, seven-tenths of the depth of one tooth multiplied by two, plus the diameter of the wheel at the bottom of the teeth, is the pitch diameter. This sum multiplied by 3·1416 gives the pitch circumference. This sum divided by the number of teeth gives the pitch. 3. Is it practical to line a horizontal engine without taking the piston out of the cylinder; if so, the best way to do it? A. It is practical to line a horizontal engine without taking out the piston, but it requires a practiced eye to work with outside lines. Lay a line over the center of the piston by plumbing down to center of head and rod; another line at the side of the piston on a level with the centers of head and rod. Measure your centers from each line, and set shaft and crank pin—the engine bed being first made level both ways, and the shaft bearing centers also made level with your center alignment.

(57) G. H. E. asks: Why are not dry gas meters used in place of wet ones? A. The dry meter is now the standard meter used by the great gas companies. The wet meter requires much care, and is liable to freeze in cold weather.

(58) E. Le D. asks how to clean nickel plated goods, so as to keep them bright? I have an Albo carbon cluster light (gas) in nickel, and I suppose the heat keeps it dull. A. Too much polishing with powder will soon destroy the nickel plating. Wipe thoroughly with a cloth moistened with kerosene oil as often as necessary. Occasionally add a little whiting or chalk to the cloths. If any parts are not burnished that require to be cleaned, a small brush with chalk and soap water will make the work quite clean.

(59) W. A. M. asks: 1. If an engine with an oscillating cylinder 1½ in. bore and 3¾ in. stroke would drive a boat 12 ft. long by 2 ft. 9 in. beam? A. Probably about 5 miles per hour, if the boat is of good model. 2. What size boiler would suit the above engine? A. Boiler should have about 43 sq. ft. fire surface.

(60) J. F. H. asks: Which of the two exhausts do you consider the best—a single or double nozzle—for a locomotive, or in fact for any kind of double engine? If you have preference for either, will you please state why? A. If strong draught is required a single nozzle is best, as it can be central to the chimney, but it must be borne in mind that with one nozzle, for exhausting from two engines, whatever be the back pressure produced, it affects *both* engines more than a double or twin nozzle.

(61) F. W. C. asks: Will a 3 in. pipe 50 rods long supply sufficient water for 2 rams, one using a 1 in. feed pipe, one a 2 in. feed pipe? A. What head is there on the 3 in. pipe, or how high is the reservoir which receives the water from brook above that which supplies the ram? If this is 8 ft. or more, 3 in. pipe is sufficient.

(62) W. S. M. asks for a receipt for sticking brass ornaments on to vegetable ivory? A. The following cement, which is recommended as satisfactory in attaching any metallic substance to glass or porcelain, will undoubtedly be satisfactory to you: Mix 2 oz. of a thick solution of glue with 1 oz. linseed oil varnish or ¾ oz. Venice turpentine; boil them together, stirring them until they mix as thoroughly as possible. The pieces cemented should be tied together for 2 or 3 days. See also receipts given on page 131, SCIENTIFIC AMERICAN for March 1, 1884.

(63) J. B. McC. asks if there is a composition that, put on rusty shafting, when taken off will take the rust off with it? A. Dip or treat the shafting with a solution of one part of sulphuric acid in ten parts of water. On withdrawing the articles from the acid solution, they should be dipped in a bath of hot lime water and held there until they become so heated that they will dry immediately when taken out. Then if they are rubbed with dry bran or sawdust, there will be an almost chemically clean surface left, to which zinc will adhere readily.

(64) W. H. H. asks: Can you state the name of the vessel which first crossed the Atlantic between England and America by steam? A. The American steamer Savannah went from Savannah, Ga., to Liverpool in 1819. This was the first steam propelled vessel to cross the Atlantic.

(65) S. E. asks: What is the drawing and lifting power of the strongest magnet? A. You do not say whether you mean permanent or electro magnet. There is scarcely any limit to the size an electro magnet can be made. Without knowing something of what you require we cannot help you.

(66) B. asks: What is the greatest speed ever attained by an ice boat, and if it attains a greater speed than the rate at which the wind blows at the time it is propelled? What explanation can be given for the fact that boat goes faster than the wind? A. With a twenty mile per hour breeze ice boats have run, on fine ice, at the rate of 70 miles an hour. If you squeeze a suitable wedge between thumb and finger, you will find the wedge to move further and faster during the squeeze than the fingers that impart the movement. On the same principle the ice boat, which is the wedge, may be driven three times or more faster than the propelling wind, when the latter acts against the inclined side or sail of the boat. If the wind were directly abaft, the boat would not go quite so fast as the wind.

(67) J. E. E. writes: 1. I have made one of the dynamo electric machines as described in the SUPPLEMENT, and I am satisfied it will work well if I can get the commutator in the right position. I cannot understand how or when it should change. A. The change should take place when the poles of the armature begin to recede from the poles of the field magnet. 2. How large a machine will I require to produce a light equal to two 4 ft. gas burners? A. A machine three or four times the size of the one referred to should afford as much light as two 4 ft. gas burners.

(68) A. McD. G. writes: I have a Daniell's battery of 4 cells, with which I am trying to do some electrotyping. Construction of the battery is correct, connections all right, and a good current is produced. But instead of a plate of copper, that metal is deposited on the mould in *powder*, which crumbles on being touched. Please tell me what is the matter? A. Try connecting your battery for a quantity current.

(69) H. G. E. asks: 1. What weight per square foot would solid ice 2 feet in thickness sustain, the ice resting upon the water surface? Could a train of cars cross in safety? A. Ice 8 inches thick will bear a weight upon sledges of 1,000 pounds per square foot (Haswell). We have no doubt that ice 2 feet thick will bear a railroad train if the rails are properly laid on the ice. 2. What ratio will correctly give the horse power of a body of water of different heads? A. To compute the power of a fall of water, multiply the volume of the flowing water in cubic feet per minute by 62·5 (the weight of a cubic foot of water), and this product by the vertical height of the fall in feet. Divide this sum by 33,000 for the horse power.

(70) A. N. J. asks: What form of a solid stands the greatest twisting strain—cylindrical, prismoidal, or other form? A. The cylindrical.

(71) J. M. G. asks: 1. What is a Bunsen gas burner, and how is it constructed? A. A Bunsen gas burner is one that burns with a non-luminous flame. It is often made by slipping a tube 3 or 4 inches long over an ordinary gas burner, and drilling air holes in the tube opposite the top of the gas burner. 2. What kind of a thermometer is used for high temperatures, such as melted cast iron, lead, or tin; and what is it made of? A. Pyrometers are used for high temperatures. See our advertising columns for these instruments.

(72) F. J. H. asks: 1. What the meaning of terms, mounted in tension and arranged for quantity? A. A battery is said to be connected for tension when the positive pole of one cell is connected with the negative pole of the adjacent cell, and so on. A battery is connected for quantity when all the positive poles communicate with one conductor, and all of the negative poles communicate with another conductor. 2. How shall I arrange a bichromate of potash battery for incandescent electric lighting? A. Connect it for tension. 3. What shall I coat an oak box with to protect it from the acid of a bichromate of potash battery? A. You might soak the wood in paraffine. Better use glass jars.

(73) O. A. B. asks: What size and quantity of magnet wire should be wound on a round iron core ¼ in. by 10 in., to make the strongest magnet, for a short time, with a single Leclanche cell, prism form, telephone size? Wind the opposite ends for 2½ in. with No. 24 silk covered copper wire. Let the depth of the winding be about ¼ in. or ⅜ in.

(74) E. A. G. asks: 1. What is the value or strength of exhaust steam as compared with live steam? A. Exhaust steam to have any value as a motive power must escape from the cylinder under pressure, and will detract so much from the efficiency of the engine; but in compound engines, where the exhaust of the high pressure cylinder operates the piston of the low pressure cylinder, a great gain in economy is claimed. 2. If exhaust steam is worked three times in an engine, what is the comparative strength of the steam in the workings? A. It depends altogether upon the manner in which it is worked. We doubt the utility of the third cylinder. 3. From whom could one get a disinterested, yet practical and scientific, opinion of the merits of a newly patented steam engine as compared with other engines? A. In any of our engineering schools you will find persons who would make the required tests.

(75) W. F. L. asks: How the carbon buttons in Blake transmitters are polished? A. You can readily polish the carbon button of a Blake transmitter by using the finer grades of French emery paper. Place the emery paper face upward on a level surface and rub the button on it.

(76) C. W. C. asks: What size pipes should be used to bring 15,000 gallons of water every 24 hours 4 miles under 150 feet head? Want the smallest that would do the work. A. This depends much upon bends in the pipe and smoothness of the bore. We would not recommend pipe less than 1¼ inch diameter.

(77) C. A. W. asks: Can you inform me how the papier mache fruit, etc., as used on the stage is made? Papier mache leaves, fruit, etc., are made by pressing the moistened paper, thick or thin according to the kind of work, in moulds, and then drying in the mould. Moulds should be slightly oiled with linseed oil boiled. Fruit is pressed in halves, and glued together. There is something in SCIENTIFIC AMERICAN or SUPPLEMENT about papier mache.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. P. C.—The specimen sent has no economic value as far as we know, except to dealers in minerals. Their valuation of it, however, would be very low.

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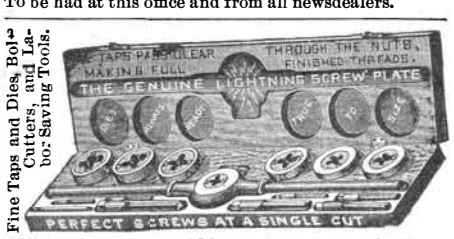
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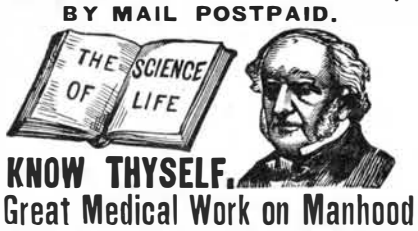


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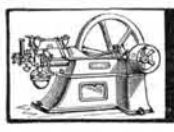

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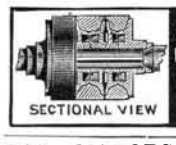


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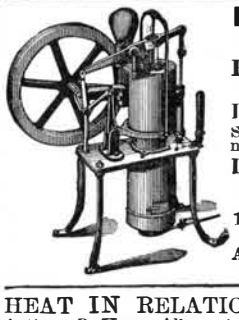

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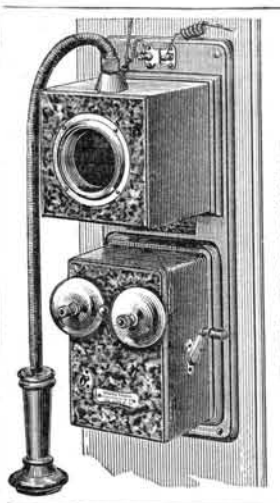

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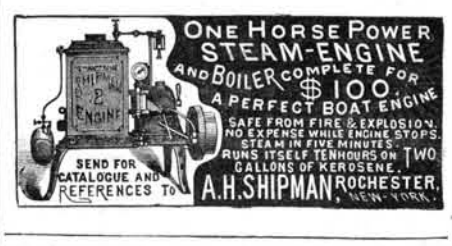
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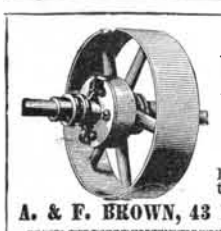

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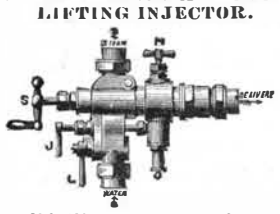

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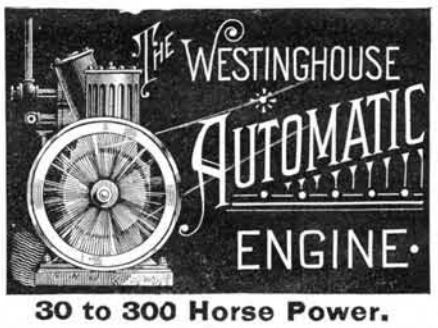


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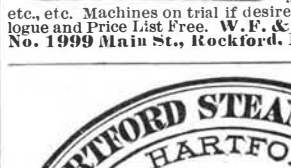

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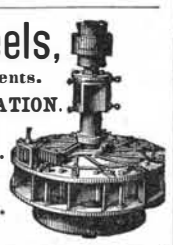

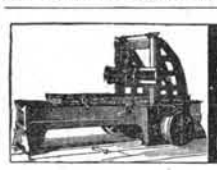



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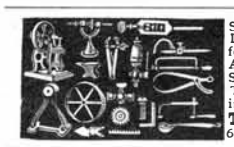

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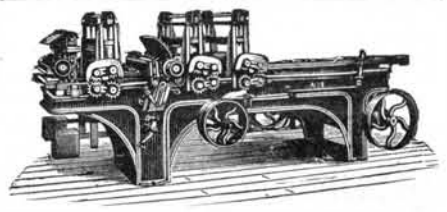

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